NEXSTORM LITE™

Version 1.0

USER MANUAL

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INTRODUCTION

Congratulations on installing the NexStorm Lite edition!

NexStorm Lite is a Windows 32-bit multi-threaded application utilizing the Microsoft Windows pre-emptive multitasking capabilities in the most efficient way. While the main thread of execution communicates with the Boltek lightning detector and performs various computations, other threads in the application which run in parallel to the main thread will handle things like drawing strike and storm symbols on the map, analyze the stroke signal waveshapes or counting strikes.

Our main goal with NexStorm Lite was to provide the end user with an application that is stable, reliable, highly accurate in terms of lightning locating accuracy, and focused on features that the user will actually need and use. Usability, presentation and superb accuracy is why NexStorm Lite's big brother NexStorm has become the lightning analysis software of choice for Boltek lightning detector owners around the world.

For detailed information about the advanced features of NexStorm *Standard Edition* please see Appendix A

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TERMS AND NOTATIONS USED IN THIS MANUAL

Terms

TRAC	Thunderstorm Ranging and Acquisition subprocess.
Ranging	a computational process used to determine strike locations.
+CG	Positive cloud to ground strike.
-CG	Negative cloud to ground strike.
+IC	Positive in cloud or intracloud strike.
-IC	Negative in cloud or intracloud strike.
Left-click or Right-click	indicates you should press the left or right mouse button, usually while the mouse pointer is hovering over a specific location on the user interface.
CVM	Composite Vector Map – a proprietary scalable vector map format for use in NexStorm.

Within the contents of this manual *NexStorm* and *NexStorm Lite* are used interchangeably and refer to the NexStorm Lite version which you have installed on disk.

Notations

Throughout this text there are shorthand notations used to indicate what you should do to access a specific section of the user interface. For instance **Options->Configuration->System** means that you should select Option from the main menu, then select Configuration from the drop-down menu, and finally select the System tab in the Configuration dialog that subsequently opens. **Configuration->System** means exactly the same thing, only here, the main menu item Options has been omitted and it is assumed that you know how where to find the Configuration menu option.

Ctrl+[Letter] denotes shortcut keys. In the case of **Ctrl+S** you should press and hold the Ctrl-key while simultaneously pressing the S key. This particular action will save your configuration settings without the need to explicitly open the NexStorm menu and selecting ”Save settings”.

Words written in *italic* are in some cases used for sake of clarity to indicate a configurable function, a concept used in the software or a particular menu option.

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NEXSTORM LITE DIRECTORY STRUCTURE

This section will briefly explain the organization of NexStorm Lite folders and subfolders and the contents that can be found in each folder. The NexStorm Lite installation folder, sometimes also referred to as home directory, is created by the installation program and the actual location on disk is chosen by the user during the installation process. If you the application was installed in the default directory suggested by the installer, your NexStorm Lite files will be located in C:\Program Files\Astrogenic\NexStormLite\.

The listing below applies to the directory structure found inside the installation folder irrespective of its location on the hard drive.

Folders

\ctrparam	Control parameter data and core processing variables file (filename cpd.0) This file is hot-swappable, if you receive a newer version of the control parameters file from us you will not need to restart NexStorm Lite to replace the file, just drop the new cpd.0 file in this folder while NexStorm Lite is running.
\docs	NexStorm Lite documentation.
\driver	Windows 2000/XP/2003 Server/Vista installation program for our Boltek StormTracker ISA card and PC-speaker sound device driver.
\rkernel	Segmented ranging correction kernels (filename *.krn).
\sound	Supplied sounds for use with NexStorm Lite, WAV-file format. You can also put your own sounds here.
\util	Contains the NexMap utility for creating your own background maps.
\graph	This directory is created when you run NexStorm Lite and will contain strike rate graph data that is loaded into memory after the software is restarted.

Note!

Under Windows Vista, several of these folders and certain files mentioned below may be stored in the *Virtual Store*. See *Windows Vista notes* section on next page for more details.

Files

NexStormLite.exe gfx.dll StormPCI_DLL.dll nxsplash.bmp	NexStorm Lite executable, dynamic link libraries and the splash screen image that is shown during startup.
unwise.exe	NexStorm Lite uninstaller program. Do not run unless you want to remove NexStorm Lite from your system.

Additionally, a configuration file named *confdatalt.bin and* daily lightning data archives (filename extension *.nex) will also be stored in the home directory when the program is run. Archives may be moved automatically to a different directory by using the *Move after completion* feature.

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Windows Vista notes

Unlike previous Microsoft Windows versions, Vista's new account management features will not allow software to write files to the Program Files folder unless a user with administrator privileges has explicitly configured the software to run with administrator privileges.

Because NexStorm Lite will need to store certain configuration settings and lightning data archives in its installation folder it is recommended that you configure the software to run with administrator privileges.

If you choose to not let NexStorm Lite run with administrator privileges, Windows Vista will by default redirect all NexStorm Lite file writes to the so called *Virtual Store*. Consequently, all files that NexStorm Lite produces will be found under the following path:

<*DRIVE*>:\Users\<*USERNAME*>\AppData\Local\VirtualStore\Program Files\Astrogenic\NexStorm Lite

(Above, *DRIVE* and *USERNAME* are specific to your system and user acccount)

In order to keep all NexStorm Lite-related files in one place we recommended that you allow NexStorm Lite to run with administrator privileges. For details on how to configure software to permanently run with administrator privileges please see Windows Vista Help.

Note!

If you opt to let Windows Vista redirect NexStorm Lite's files to the Virtual Store and later want to uninstall the software, the archives and other data that was redirected will not be uninstalled automatically.

This is important to know if you at any point want to perform a clean install of NexStorm Lite in which case you will have to manually delete archive and/or configuration files from the Virtual Store.

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NEXSTORM LITE MAIN WINDOW

The main window is the part of NexStorm that is always visible to the user when the application is not minimized. The largest part of the main window consists of the map area. Additionally there are three frames containing various indicators, labels and counters.
Right clicking on your mouse while the mouse pointer is over the map area will bring up a popup menu. Using this menu, colors of the map overlay components such as distance rings and labels, can be adjusted. You can also access the Map setup dialog and the Configuration->Strike symbol dialog that are also accessible through the regular menu system.

Activity frame
The topmost frame in the user interface is called the Activity frame,. It contains counters, strike and noise alert indicators and the last detected strike bearing indicator. Portions of this frame will change appearance if LD-250 is configured as the detector type in the NexStorm hardware configuration.

System frame
The midsection frame is called the System frame, it reflects certain parts of your NexStorm configuration settings and shows the current system date and time. Labels in the System frame are “clickable”, for instance clicking once on the Squelch label will bring up the Configuration dialog focused on the Hardware tab where you can adjust the receiver squelch.

Statistics frame
The bottom frame is the Statistics frame. It holds the peak strike rate counter and time indicator, the application uptime counter, plot mode indicator and the strike rate trend graph.

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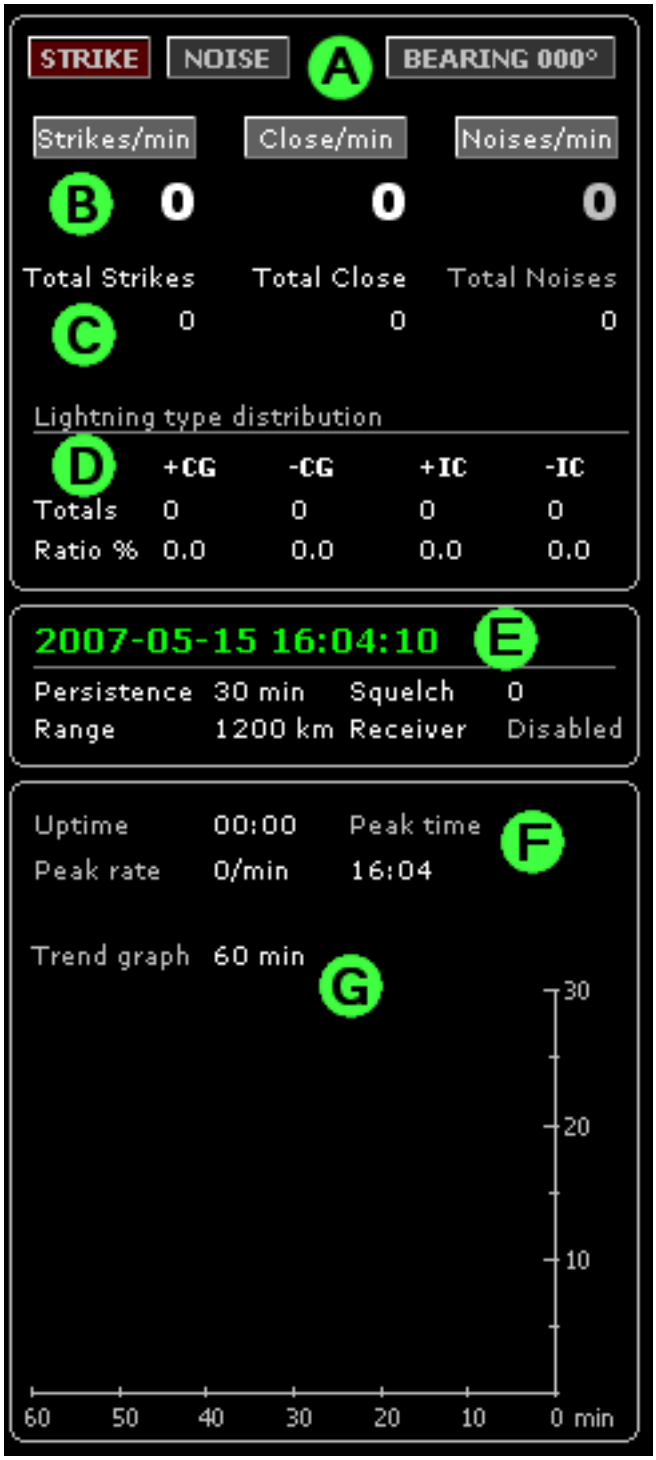

Figure 1. NexStorm Lite textual data frames

A. Strike and Noise alert indicators and the latest strike bearing indicator. The strike and noise indicators will light up when a strike or noise is detected, alerting you of the event that just occurred. The latest strike bearing indicator will display the bearing to the latest strike that was detected, making it easier for you to locate the strike on the map. To control how long the strike and noise indicators should be lit up, open the Configuration dialog, Data graphics tab and adjust the indicator's duration time. (You can also click on the System frame clock label to view the same tab in Configuration dialog.)

B. Per minute counters for strikes, close strikes and noises. Close strikes are classified according to the close alarm setting which is adjustable in the Configuration->Alarms tab dialog. The Noises counter will turn yellow if the amount of noises exceeds 20 per minute and no strikes are detected or if the strike to noise ratio exceeds 5 to 1. The latter phenomenon is very common during elevated and nearby lightning activity and could be indicative of frequent intracloud discharges, weak electrical activity or mixed component signals that were not well formed, hence could not have the directions properly determined.

Strike type ratios will not be available when the software is used with the Boltek LD-250 model, instead GPS relayed data will be shown in real time in such cases where an NMEA compatible GPS has been connected to the LD-250.

C. Total counters for all classes of strikes, close strikes and noises. This is a daily counter that will reset at midnight.

D. Totals and percentage ratios for the four different strike categories that NexStorm is able to classify. With regular, non-severe summer storms, the positively charged cloud to ground strikes should be in minority with ratios of 0 to 30 percent. During winter thunderstorms (thundersnow), the positively charged strikes can dominate although the cumulative total is likely to be relatively low. Tornadic supercells in the mid-western continental US have been recorded to contain a large amount of positive CG strikes, especially during the dissipation stage.

E. The System frame contains information about the configuration state of your NexStorm. The labels in the System frame are clickable and will open various configuration dialogs depending on which label was clicked. Right-clicking on the Range label or the currently selected range indicator label will bring up the *Quick Zoom* which lets you select a specific view range.

F. Uptime indicator and Peak rate indicator. The uptime shows how many hours and minutes the application has been running since it was started. It is only reset when NexStorm is restarted. The Peak rate indicates the highest strike rate that has occurred during application uptime or, if the application has been running for over 24 hours, within the current day. The Peak time indicates at which time the peak strike rate occurred.

The Peak rate counter is reset at midnight every day or if you exit the application.

G. The strike rate trend graph shows lightning activity for a set period of time. For more information about the graph please see the Strike rate graph section.

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NEXSTORM LITE AND BOLTEK LD-250

When NexStorm is used with the portable Boltek LD-250 detector model, the activity frame will change appearance so that it displays GPS data relayed by the LD-250 instead of the strike type distribution table. When run in LD-250 mode, one additional LD-250 specific menu item will be available under the Options menu.

With the LD-250 it is currently not possible to capture raw signal data as is the case with PCI type detectors. This is related to bandwidth limitations inherent in the communications port over which the LD-250 communicates with the PC and subsequently any interface application. Because of this limitation, which prevents NexStorm from being able to classify stroke types, and the fact that LD-250 was designed with GPS support, the activity frame strike type distribution table will be substituted by a GPS data information table whenever the software is configured for usage with the LD-250 detector.

Subsequently, in those cases where a NMEA compatible GPS device is connected to the LD-250, NexStorm will display selected GPS parameters in real time. Figure 2 shows how the activity frame will look if LD-250 is configured as the detector model under the Configuration->Hardware tab and with no GPS connected.

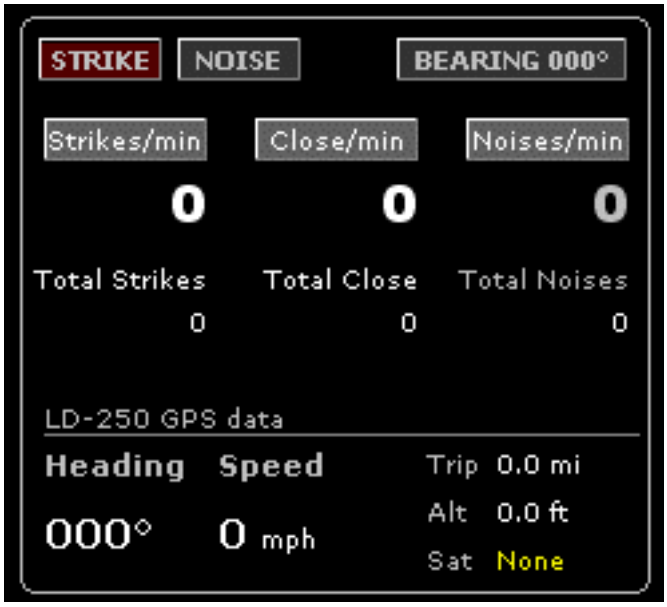

Figure 2. LD-250 mode activity frame

Heading: Shows the current heading in degrees in which the antenna is pointing. This information is retrieved from the NMEA GPGGA sentence. In addition to this reading, NexStorm can optionally draw a rotating heading pointer on the map.

Speed: Shows your current speed in km/h, miles per hour or knots. Information is retrieved from the NMEA GPRMC sentence.

Trip: A trip odometer showing the amount of distance traveled in kilometers, statue miles or nautical miles depending on the distance unit setting. This odometer is application internal and can be reset by accessing the LD-250 specific menu *LD-250 settings* under *Options*.

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Alt: Indicates the altitude (GPGGA) in either feet or meters depending on the distance units setting.

Sat: shows how many satellites are currently used by the GPS for positioning. Less than 3 satellites indicates an unreliable GPS fix and will make this indicator turn yellow. If no satellites are being received, this indicator will indicate it with the text “None” colored yellow. The satellites in view parameter is parsed from the GPGGA sentence.

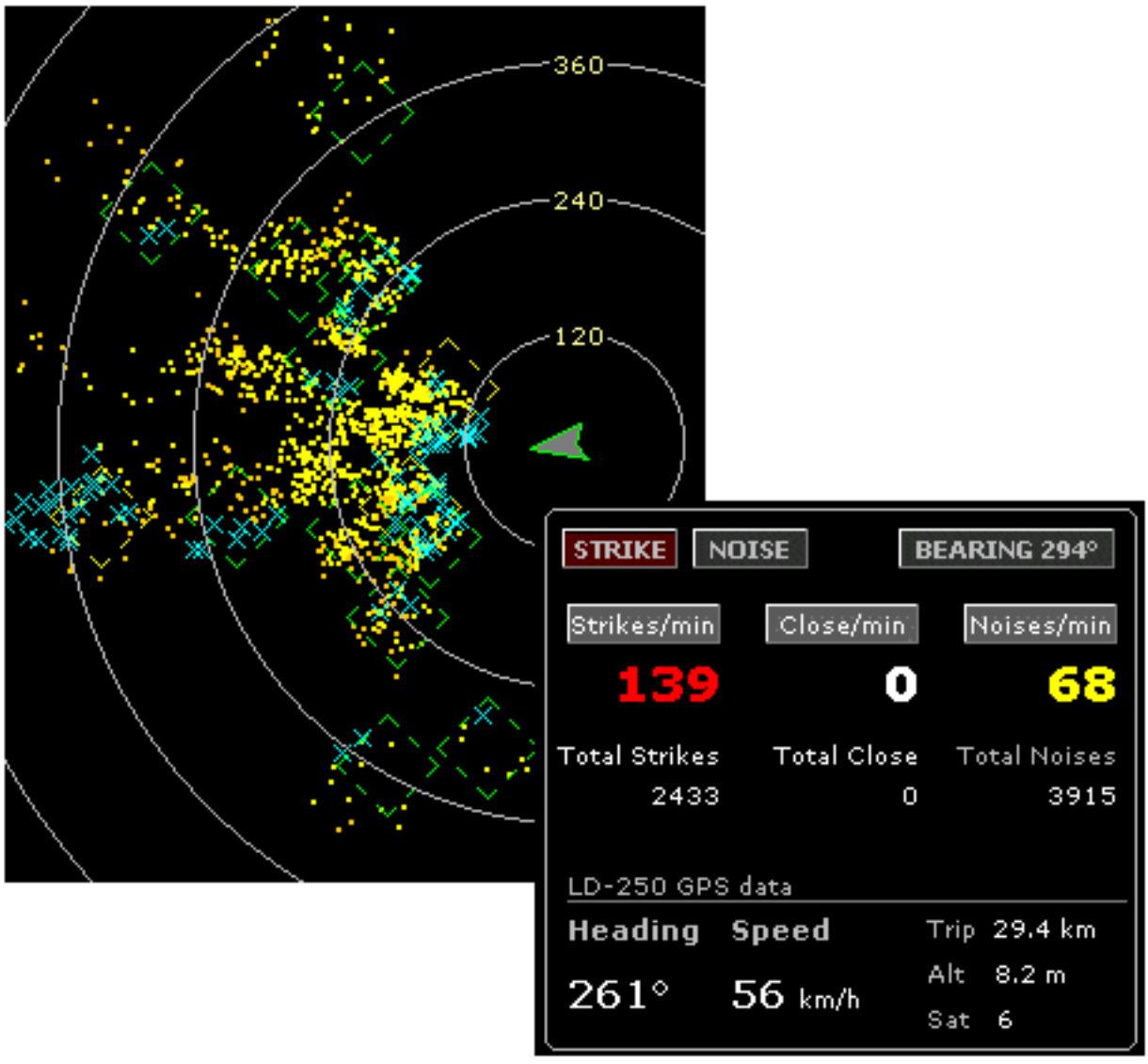

Figure 3. Stormchase during NexStorm 1.1 field tests using a Boltek LD-250 connected to a Garmin GPS-V.

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NEXSTORM LITE MENU SYSTEM

The menu system is used for navigating between different locations in a program. Using the menu you can active or deactivate functions or open hidden dialogs that lets you configure how NexStorm operates. This section walks you through the entire NexStorm menu system. To see more in depth explanations on certain options in the configuration, click on the appropriate hyperlink.

Menu: NexStorm

Map setup
(Shortcut key: Ctrl+M)
Open this dialog when you want to assign or unassign maps that are to be used in NexStorm. You can assign two Base maps and up to 14 Custom maps, one for each view range (level of zoom).

NexStorm supports the proprietary CVM (Composite Vector Map) scalable vector map format or as an alternative, if you want to make your own background maps, Windows Bitmap (bmp) images. If you create your own maps you must save the images to BMP format before being able to use them in the software.

Note!
Before assigning your own maps, you will obviously first need to create and scale them. Use the accompanying NexMap program to do this. See the NexMap documentation for details on how to create maps.

To load a map, click on the left side button with a folder depicted on it. To unassign a map, click on the red cross button on the right side.

When a custom map is loaded it will automatically be assigned to the zoom-level you currently are in. For instance, to assign a custom map to the 300 km range, first zoom in so that the outermost distance ring displays 300 km (use the Insert and Delete buttons for zooming). Load a previously prepared and scaled bitmap. Repeat this process for each range that you wish to assign a custom map to.

A base map can be assigned irrespective of which zoom-level you have selected. Besides this slight difference compared to custom map assignment, the map setup process is identical.

Base maps can be assigned as either a full range or medium range base map. The difference is the area of geographical coverage. While the full range base map needs to cover the entire 1200 km (750 mi) view range, the medium range map should only cover half this range, e.g. 600 km (375 mi). The reason for having two different base maps is because to the pixelation effect that becomes evident on images with high magnification factors. With two base maps this problem can be reduced as the medium range base map is better adapted for showing closer view ranges while the full range map is better for more distant ranges.

A note on map rendering order
The medium range base map has precedence over the full range base map so that if you have assigned both, once the view range is inbound of 600 km (375 mi) the medium range map will be rendered in the map window instead of the full range map. Similarly, if a CVM map is assigned, it will be rendered at all view ranges irrespective of any base maps that are assigned. Lastly, any custom zoom-level maps that you assign will be rendered at their respective view ranges irrespective of what other type of map is assigned. This rendering priority procedure is called Z-ordering and allows you to extensively configure your map display without the need to constantly load and unload maps.

Note!
Although the NexStorm maximum view range is 1200 km/750 miles, this in no way implies that your lightning detection system will be capable of tracking thunderstorms at that range. Generally, ranging of storms becomes increasingly unreliable with increased distance and at ranges over 500 km/300 miles there is no guarantee that any kind of signals produced by lightning can be captured by the Boltek system.

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Clear strikes
Clears the map display of all strike symbols that were drawn prior to the current time.

Replot strikes
Replots all strikes between current time and the Persistence limit

Replay
(Shortcut key: Ctrl+R)
Opens the archive player dialog that allows you to playback older archives. Refer to the Replay section for details on how to use this feature.

Save settings
(Shortcut key: Ctrl+S)
Will save your current settings and display a confirmation dialog if the save were performed successfully. The changes you make in your configuration are saved every time you exit the program, you should use Save settings to ensure that the settings are saved immediately after a change or your configuration changes might disappear in case of a power outage or system crash.

Hide when minimized
Enable to place the NexStorm icon in the system tray when the application is minimized. Double click on the NexStorm system tray icon to bring back its window to the desktop.

Start minimized
Enable to have NexStorm start minimized to the task bar or system tray instead of displaying the main window when started.

Start on login
Enable to have NexStorm start automatically when you logon to your Windows desktop

Startup delay period
Add a startup delay period if you are experiencing problems with the receiver not connecting properly when *Start on login* is used. These kind of problems can be related to driver misconfiguration or unexpected delays in the driver startup. Using a delay period will allow the relevant driver to start up and initialize before NexStorm attempts to access the receiver hardware for the first time.

Exit
Quit the program.

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Menu: Options

Configuration
(Shortcut key Ctrl+C)
Open the Configuration dialog. This is a tabbed dialog where each tab allows the configuration of a specific part of the application. Refer to the Configuration section in this manual for further details.

TRAC Report
(Shortcut key Ctrl+T)
TRAC is the NexStorm strike analysis subprocess. The TRAC Report dialog will list all detected thunderstorms in a table. One line in the table represents one stormcell that has been targeted by the TRAC subprocess.

In this dialog you also have the option to enable the On-map Ident feature. On-map Ident will attach a tag to each stormcell on the map. The tag contains coded information about the nature and behavior of a particular storm.

To learn more about TRAC and On-map Ident, refer to the TRAC section of this manual.

Segmented Ranging Correction
With the segmented ranging correction you can tune the way NexStorm will range strikes in different directions and distances. Subsequently, this will affect the TRAC subprocess and how close or far away a storm is determined to be. Contrary to the general ranging correction described later, the segmented ranging only applies to a specific sector and/or distance. A complete segmented ranging correction configuration is called a kernel. A kernel can be saved to or loaded from disk. For hints and examples on how to use this feature, refer to the Segmented Ranging section of this manual.

Ranging adjustments
(Shortcut key Ctrl+Z)
Selecting this menu option will open the Configuration dialog and focus it on the Ranging tab where you can make generic (non-segmented) ranging calibrations.

Display mode
NexStorm supports 3 different display modes ranging from 800x600 up to a maximum of 1152x864 pixels. The display mode determines how large part of your desktop area the NexStorm graphical user interface will occupy. Choosing Autosize as the display mode will make NexStorm attempt to occupy the full desktop area up to a screen resolution of 1152x864 pixels. If your system is configured for a higher screen resolution than this, the display mode will default to the maximum available size of 1152x864.

Zoom
(Insert/Delete buttons) Use this feature to zoom the map in or out on your map.

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LD-250 settings
This option is only visible if the detector model has been set to LD-250 under the Hardware tab. *LD-250 settings* contains a submenu with the following options:

Noise beeps: Check this option if you want your LD-250 unit to beep when it detects noises
Disable heading indicator: The heading indicator will point towards the heading that the antenna is facing if a GPS device is connected to the LD-250. Check this option if you want to hide the heading pointer.
Reset trip meter: Resets the internal trip odometer and will restart counting traveled distance from zero.

Menu: Trend graph

Increase time scale
(Shortcut key F1)
Increase the trend graph time series interval

Decrease time scale
(Shortcut key F2)
Decrease the trend graph time series interval

Smooth
(Shortcut key F3)
Enable or disable smoothing

Stacked
(Shortcut key F4)
Enable or disable stacked graph mode (not available with LD-250)

Trend graph settings
(Shortcut key Ctrl+G)
Open the Data graphics configuration dialog. For more information about the graph, please refer to the section Type differentiated strike rate trend graph

Menu: Help

Enable Hints
(also known as Tool tips)
Check this menu item if you want to be able to get hints on different items and labels that are part of the NexStorm user interface. To read a hint after enabling this feature, hover your mouse pointer over the item in question. Note that not all items have hints attached to them, some are considered self-explanatory by name and should not require hints for understanding their basic function.

Astrogenic Systems website
Will open Astrogenic Systems website in a new web browser window

Upgrade NexStorm
Will open a dialog containing information about what additional features you will get when upgrading to the regular NexStorm version.

Support forum
Will open Astrogenic Systems support forum website in a new web browser window

About
This dialog holds the version number of your NexStorm installation as well as revision numbers of the processing core and control parameters. Always include this information when asking for support.

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CONFIGURATION OPTIONS DIALOG

This is by far the most content-packed dialog in the application. In here you will be able to configure most of the configurable features available in the software. Open this dialog by pressing Ctrl+C, through the regular menu system (Options->Configuration) or by clicking on one of the labels in the System frame.

The Configuration dialog is a tabbed dialog, under each tab you will find a separate dialog containing configuration options for a specific part of the program. Let's step through the available tabs.

Map graphics tab

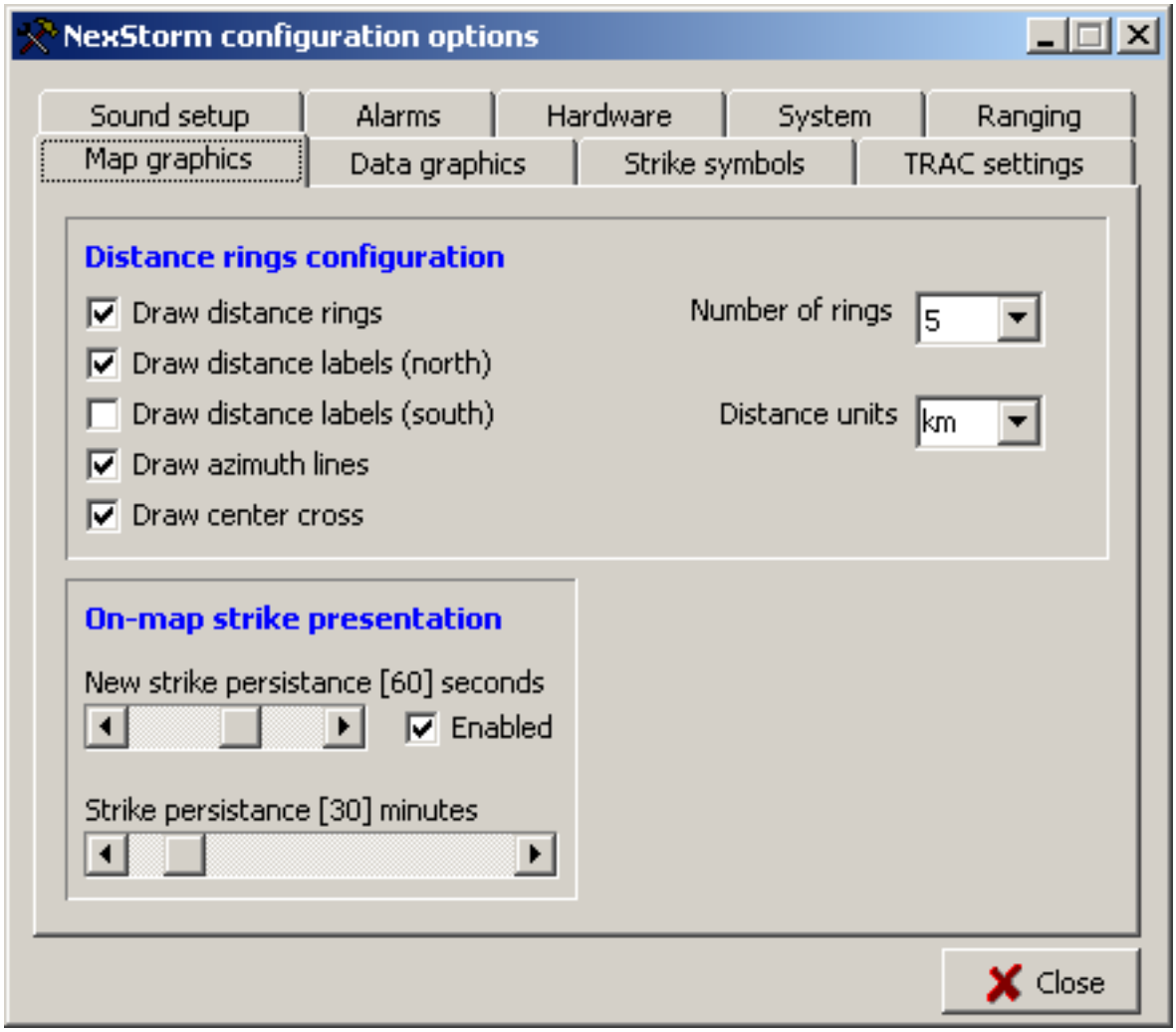

Figure 4. Configuration dialog, Map settings tab

Distance rings configuration
Configures the map overlay graphics. The map overlay consists of distance rings and labels, azimuth lines and a center cross. One additional item that can be drawn on the map is the Close alarm range ring. This component is configured under the Alarm tab described in a later section.

You can configure which components of the overlay will be visible on the map by checking the corresponding checkboxes. Use the dropdown lists to change the number of distance rings that are shown on the map or to change the units used for distance ring labels and other measurements in the program. The available distance measurement units are kilometers (km), statue miles (sm) or nautical miles (nm).

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On-map strike presentation
Under this tab you will also find settings for strike persistence and new strike persistence. The persistence setting controls how long a strike plot will be visible on the map. The checkbox New strike enabled will disable the new strike flag if unchecked.

To setup which strike symbols and history color-coding to use, click on the Strike symbols tab.

Tip!
To configure map overlay colors, click the right mouse button while the mouse cursor is hovering over the map window. A pop-up menu will appear allowing you to chose which component of the overlay you want to adjust the color for. This pop-up menu also contains shortcuts to other application configuration dialogs: The Map setup, Vector map configuration, Map graphics and Strike symbol configuration dialogs can all be accessed directly from here.

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Data graphics tab

(Shortcut key Ctrl+G)

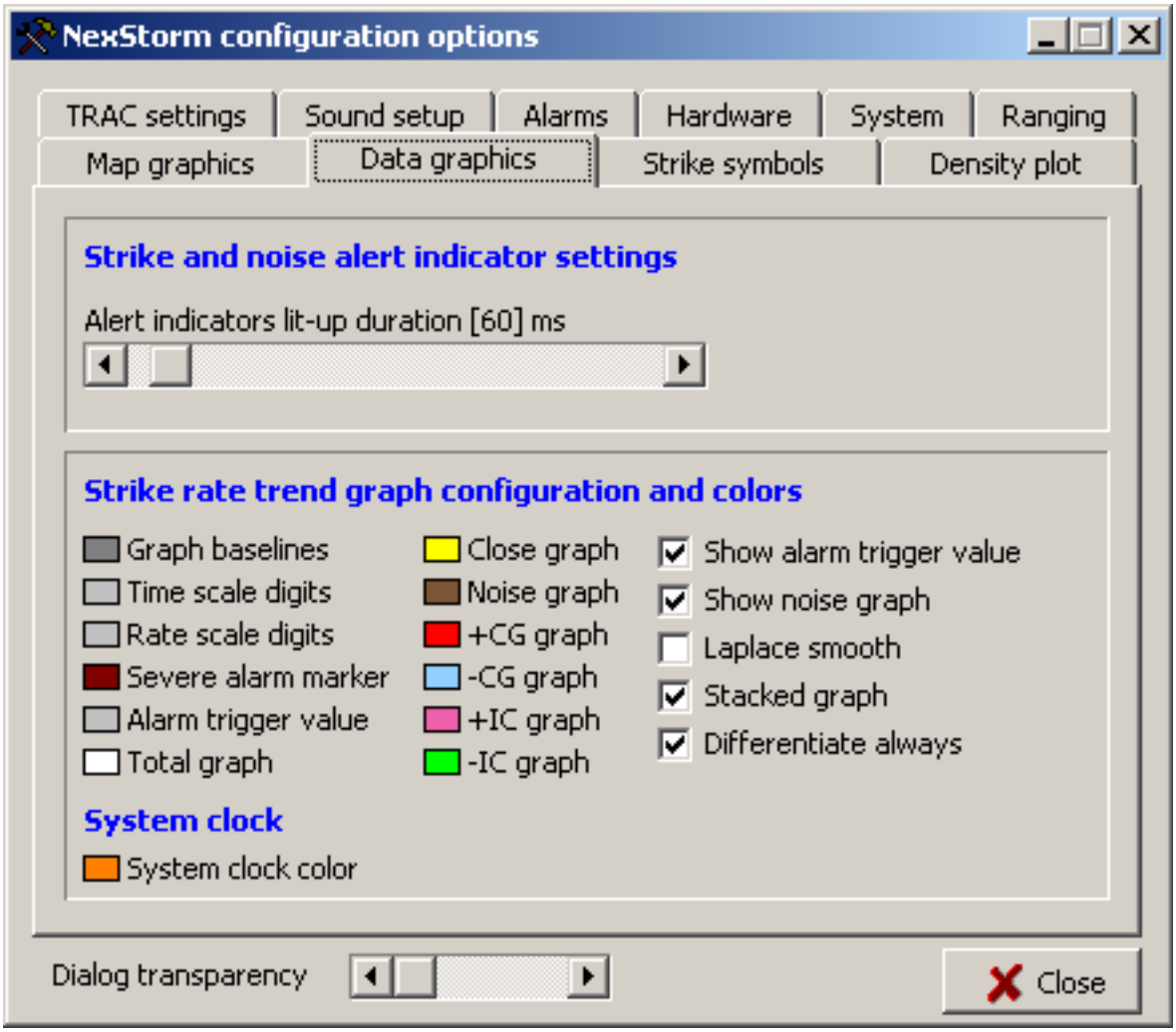

Figure 5: Configuration options for the graph and system clock colors

Strike and noise alert indicator settings

Alert indicators lit-up duration will adjusts how long time in milliseconds the strike and noise indicators will be lit when either is detected by the program. Move the slider tab back and forth to adjust this time.

Strike rate trend graph configuration and colors
Allows you to configure the different strike rate graph colors.

To change a color, click on one of the color boxes. A color picker dialog will open and allow you to change the default color to one of your choice.

The selectable options are described in detail in the Type differentiated strike rate trend graph section.

System clock color
Allows you to change the default color of the main window date/time to a color of your choice.

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Strike symbols tab

Use this dialog to configure the symbol generator, assigning strike symbols to be used for plotting different categories of strikes on the map.

NexStorm can discriminate between two types of lightning, cloud to ground (CG) or intracloud/in cloud strokes (IC). Additional filtering is done based on the polarity of the stroke and can be either positive or negative. The NexStorm symbol generator allows you to visually discriminate between these four distinctive types of strikes when they are plotted on the map.

Strike symbol configuration
To change a strike symbol for a specific type of strike, you must first select which type you want to change. You do this by selecting the strike age (New Strike or Old strike button) and the strike classification (radionbuttons -CG, -IC, +CG, +IC) Each combination can be configured to have a unique symbol setting. (Note that the default configuration does not discriminate between the four possible stroke types.)

After selecting which strike you want to change you need to assign a symbol for it, you can browse through all available symbols by clicking on the left and right buttons located at the bottom of the symbol preview area. To change the size of symbols, press the up or down buttons located to the right of the symbol preview area.

If you need to assign a different color to a particular type of strike, click on the Color button to open the color picker dialog.

The Equalize button is used to neutralize the visual discrimination of strikes by setting all symbols to be equal as the currently selected strike category. This means that if you press this button, all categories of strikes will use the same symbols for New strike and Old strike as the currently selected category.

Note!
Due to its long continuing current, a positive cloud to ground stroke (+CG) is considered to be one of the most dangerous forms of lightning and is often the cause of lightning initiated fires and human deaths.

Studies show that many +CG strikes originate from the anvil at the top of the Cumulonimbus cloud which is the type of cloud associated with thunderstorms. As the cloud tops due to atmospheric conditions generally are lower at higher latitudes, the distance between the cloud top and the ground becomes shorter. This shortened cloud to ground traveling distance creates more favorable conditions for a +CG discharge and is why this type of strike is more likely to occur the farther north or south you are in the world. At southern latitudes, storms with predominantly +CG discharges are likely to be severe with a potential of producing large hail and tornadoes.

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Strike history color codes
Color coding strikes by their age is useful for determining which way a storm is moving and to see where the most recent activity is occurring. Adjust these settings to your preferences by selecting colors for different ages and by altering the interval breakpoint slider. Keep in mind that this feature is in a way dependent on the persistence setting. To allow the use of all available color codes, your Strike persistence setting (Map graphics dialog) should be matched with the Interval breakpoint in this dialog. For instance, an interval breakpoint of 10 and a Strike persistence setting of 30 minutes will discard the last three color codes since they are outside the persistence setting time range.

Tip!
You can decrease the number of color codes used by intentionally adjusting the settings in a way so that the last few colors fall outside of the persistence setting. Strikes older than the maximum persistence setting will not be plotted on the map.

Select a color for a specific interval by clicking on the color boxes to the left of the interval times. The topmost color (first interval) is configured by setting the Old strike color, clicking on its color box will not open the color picker dialog.

The history color coding feature is not discriminating by category, it will colorize all strikes equally irrespective of their type or polarity. The strike type discrimination is only done on the New strike and Old strike plots until the secondary interval becomes active.

The Reset history colors button will restore NexStorm's default color coding settings.

To deactivate the use of history color coding, uncheck the checkbox named Color-coding enabled.

On-map legend
Check this option if you want to superimpose a legend on the map that is reflecting your Strike Symbols setting. To change which corner of the map the legend will be rendered in, right-click on the map and select an appropriate position using the *Legend position* sub-menu in the pop-up.

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TRAC settings tab

Thunderstorm Ranging and Acquisition - TRAC for short - is a subprocess in NexStorm that computes thunderstorm locations, tracks their movement and analyzes trends and characteristics of a storm. Details about the TRAC process is located in the section describing the TRAC Report dialog.

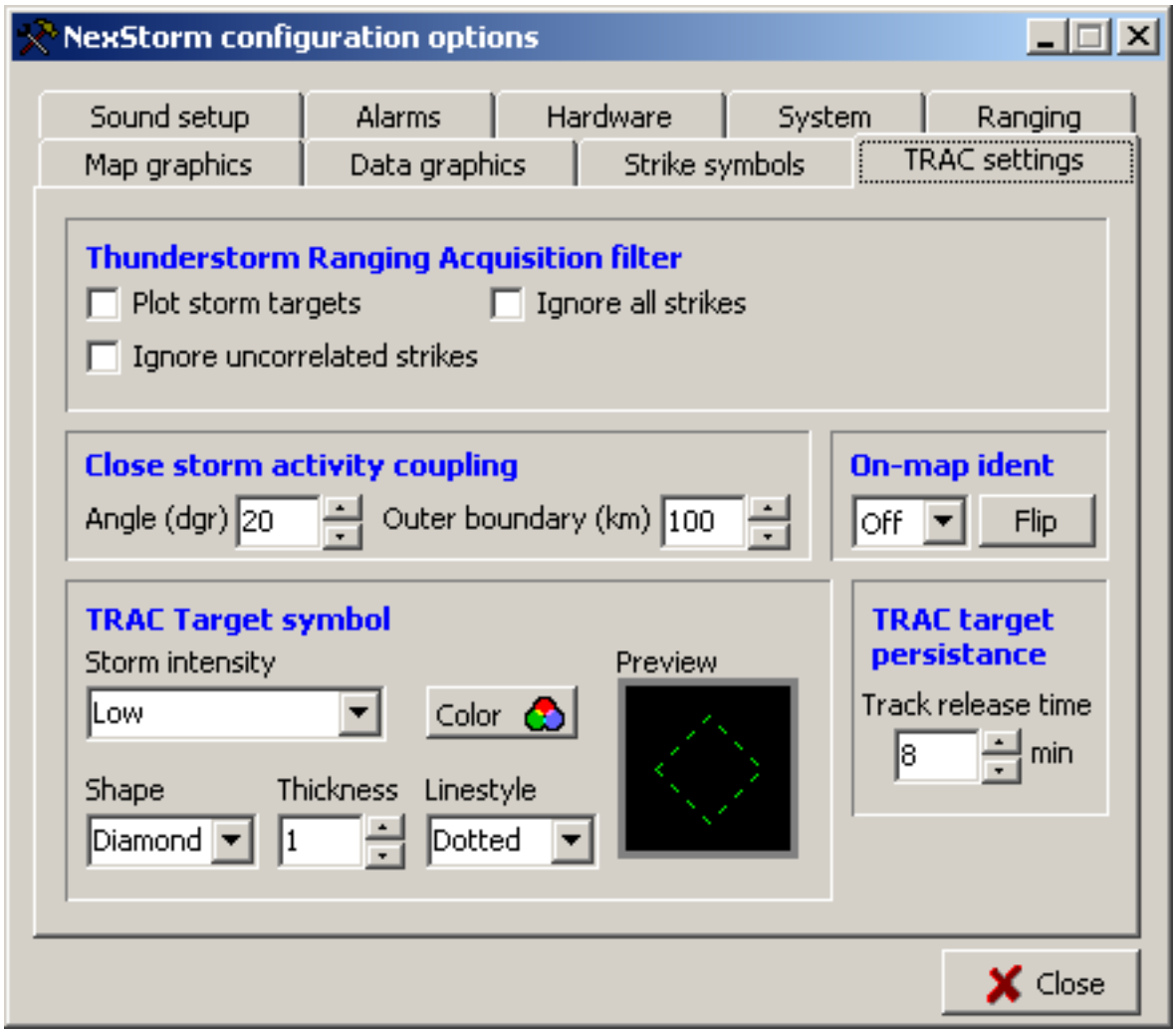

Figure 6. TRAC settings tab

Plot storm targets — Enables or disables plotting of TRAC target symbols on the map. A TRAC target is NexStorm's analytical guess on where storms are located. Due to the nature of single antenna positioning systems, it will not always be correct but will in most cases give you a fairly accurate positional estimation of a thunderstorm's geographical location. The symbols that are used for displaying TRAC targets are configured using TRAC target symbols settings described below.

Ignore uncorrelated strikes — An uncorrelated strike is a strike that TRAC was not able to link to any currently tracked thunderstorm. Enable this feature to de-clutter the map from sporadic strikes, thus making the whole situational analysis more easy to interpret.

Ignore all strikes — Enabling this feature will prevent any plotting of individual strikes on the map. This feature can be used when the only thing of interest is TRAC computed locations of thunderstorms.

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Close storm activity coupling

This function is critical if you want close storms to be ranged accurately and in a more natural way than would be the case with this feature disabled. The activity coupling tells NexStorm to assume that nearby storms, positioned within the *angle* parameter of the closest storm in one direction, are parts of the same storm system. Thus the range to each target will be adjusted towards the closest TRAC target though only if the more distant targets are within ± *angle*.

In some rare instances, the above logic will not apply and this could lead to incorrect ranging in certain directions. In the majority of cases however, this feature will improve ranging to close storms considerably so it is a general recommendation that you keep it enabled at all times. If you for some reason need to deactivate the activity coupling just set the angle parameter to 0 degrees.

Note also that the activity coupling will only affect storms (TRAC targets) that are inside the *Outer boundary* distance parameter.

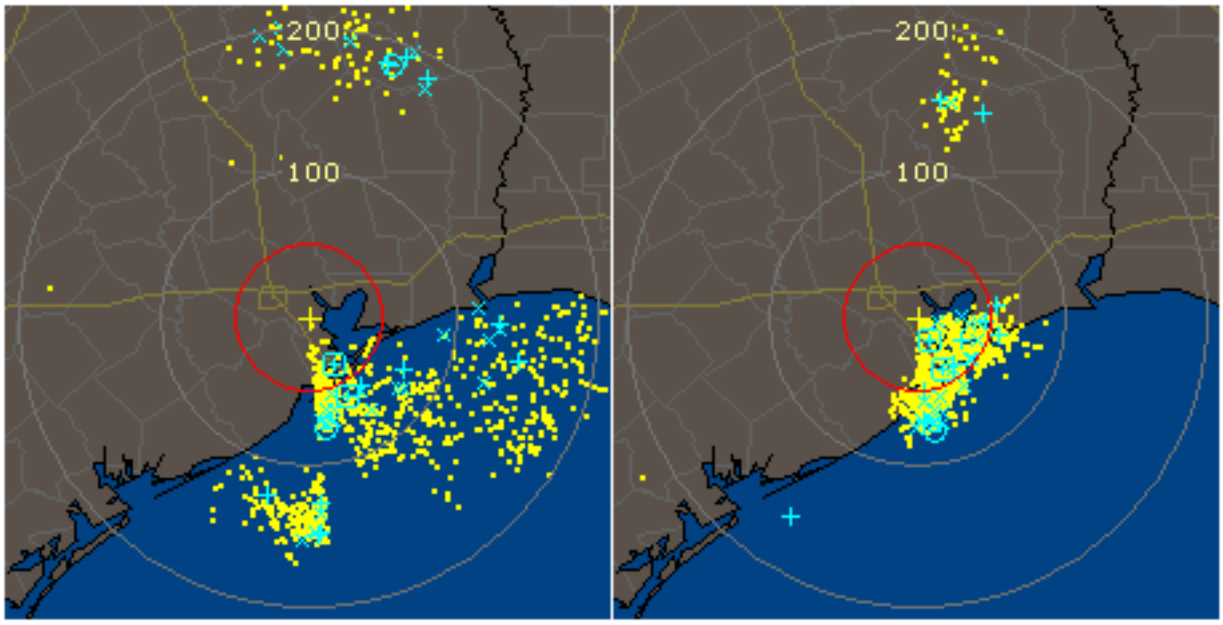

Figure 7. Left image shows how a storm system is ranged with activity coupling disabled. Right image shows the same storm at the exact same time but with activity coupling enabled (20 degrees angle, 200 km/125 mi)

Note how in figure 7 right image, cluster fragmentation is almost non-existent and the entire thunderstorm system is ranged closer with the activity coupling enabled. The right side image in fact displays exactly the storm's actual position this day while the left image is not as accurate for the clusters to either side of the nearest storm. Another notable thing is the distance to the activity closest to center. At the exact point in time when these screenshots were made, the thunderstorm was passing overhead moving towards north-east so the activity coupling is producing overall better ranging to the storm than in the left image where it was disabled. With this in mind, you can use the activity coupling when making ranging calibrations.

The angle and outer boundary values are by default set to 20 degrees and 100 km (63 mi) respectively but feel free to experiment with these values if you feel it is required.

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On-map Ident

This feature in conjunction with the TRAC target color mapping allows you to instantly see important characteristics of a storm by simply viewing it on the map. The identity text that is attached to a TRAC target is called a tag. You enable On-map ident by selecting in the drop-down box how the identify labels should be displayed, either *Single* or *All*. *Single* will attach the identification tag to the storm that was last selected in the TRAC Report table. *All* will attach identity tags to all storms that are being tracked. (Flip tag button – see TRAC Report section, Flip tag button)

The format of the ident code when viewed from left to right is as follows (example assumes an On-map ident code on the map showing **K-2332+4-**):

K-2332	Identification code for the thunderstorm, the letter and numbers are unique for each storm and are computed based on the time of detection.Look for this identification code in the TRAC Report table to locate additional information about the storm.
blue - or red +	Dominating Cloud to Ground strike polarity in this storm, can be negative (-) or positive (+).
4	last recorded strike rate.
strike rate	^ increasing v decreasing - no change or undetermined

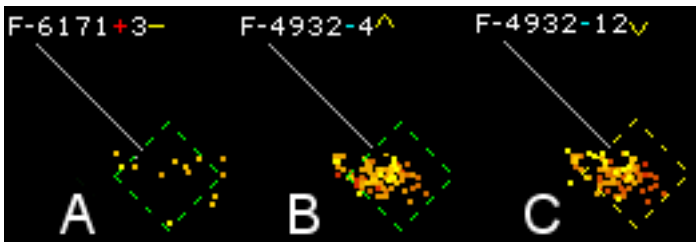

Figure 8. On-map ident examples

A
Storm identification number F-6171, dominating CG strike polarity is positive, latest recorded strike rate per minute = 3, no detectable change in strike rate.
B
Storm identification number F-4932, dominating CG strike polarity is negative, last recorded strike rate per minute = 4, the strike rate per minute is increasing.
C
Same as B a few minutes later, strike rate is now 12 strikes per minute and decreasing.

TRAC Target symbols

Sets which symbols should be used for displaying TRAC targets on the map. Targets are drawn in three colors where each color denotes a storm's intensity based on its strike rate.

Color	Strike rate/min	Classification
Green	1-10	Weak
Yellow	11-49	Moderate
Red	> 50	Strong or Severe

Table 1

Current version of NexStorm has three target symbols that you can choose from. Symbol selection is linked meaning that the symbol you select will be used for all storm target plots, irrespective of their intensity. You can alter the default colors that are used for storms in each intensity class and also modify the width of the lines that the symbols are drawn with. The dash-dot and dotted line types are only available when the line-width is set to 1 pixel.

TRAC Target persistence

This setting tells NexStorm how long time it should keep monitoring a quiet storm for additional activity. Once the configured period of time expires, the storm is considered dissipated and the program will stop tracking it. You can set the release time to anywhere between 5 and 20 minutes with the default being somewhere in between.

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Sound tab

Use this dialog to configure which sounds to use for strike and noise beeps and for the configurable alarms. You can configure NexStorm to use either your PC's internal speaker or sampled sounds in Wave file format (WAV) when playing sounds. Use the radio buttons under Select sound generation in this dialog to set which type of sounds should be used.

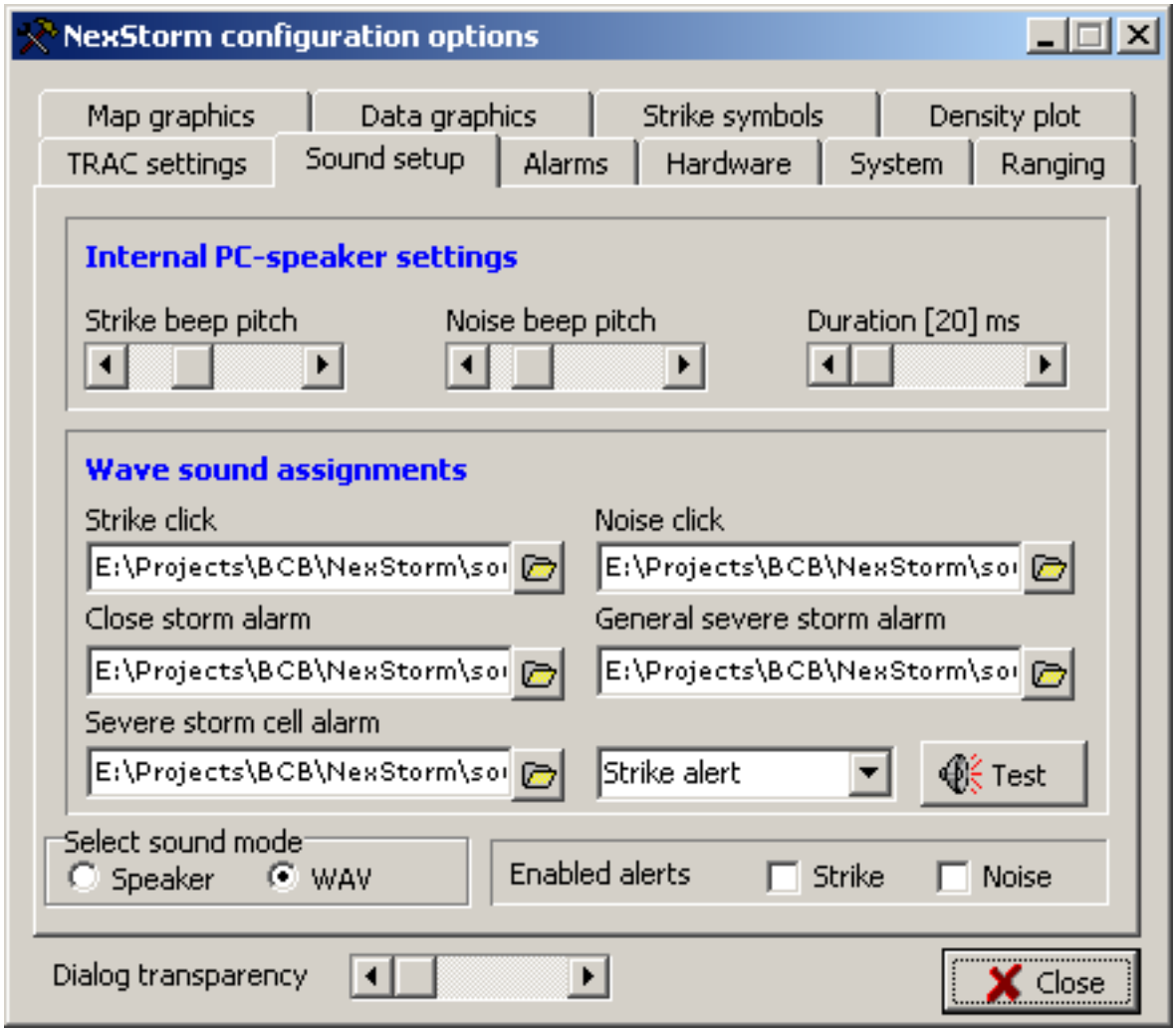

Figure 9. Sound settings tab

To alter the pitch and length of a PC-speaker generated strike or a noise alert, use the sliders under pitch and duration sliders.

To configure which sampled sounds (WAV format) NexStorm should use for alerts and alarms, click on the corresponding *Open file* button next to the edit box of the sound you want to assign.

You can test all of the assigned sounds by setting the desired sound mode, then selecting the alarm or alert you wish to hear and pressing the *Test* button. (In PC-speaker mode, the alarm sounds are pre-programmed and cannot be changed by the user.)

To unassign a sound, double click the text box for the sound that you wish to remove.

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You can disable strike and/or noise beeps by unchecking the corresponding *Enabled alert* checkboxes. Enabling or disabling alarms and setting the number of times an alarm sound will loop is done through the Alarm dialog described next.

Note!

Windows 2000 and XP users must install a special device driver in order to use PC-speaker sounds. Detailed information and installation instructions are available in the NexDrive documentation accompanying the NexStorm software package.

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Alarms tab

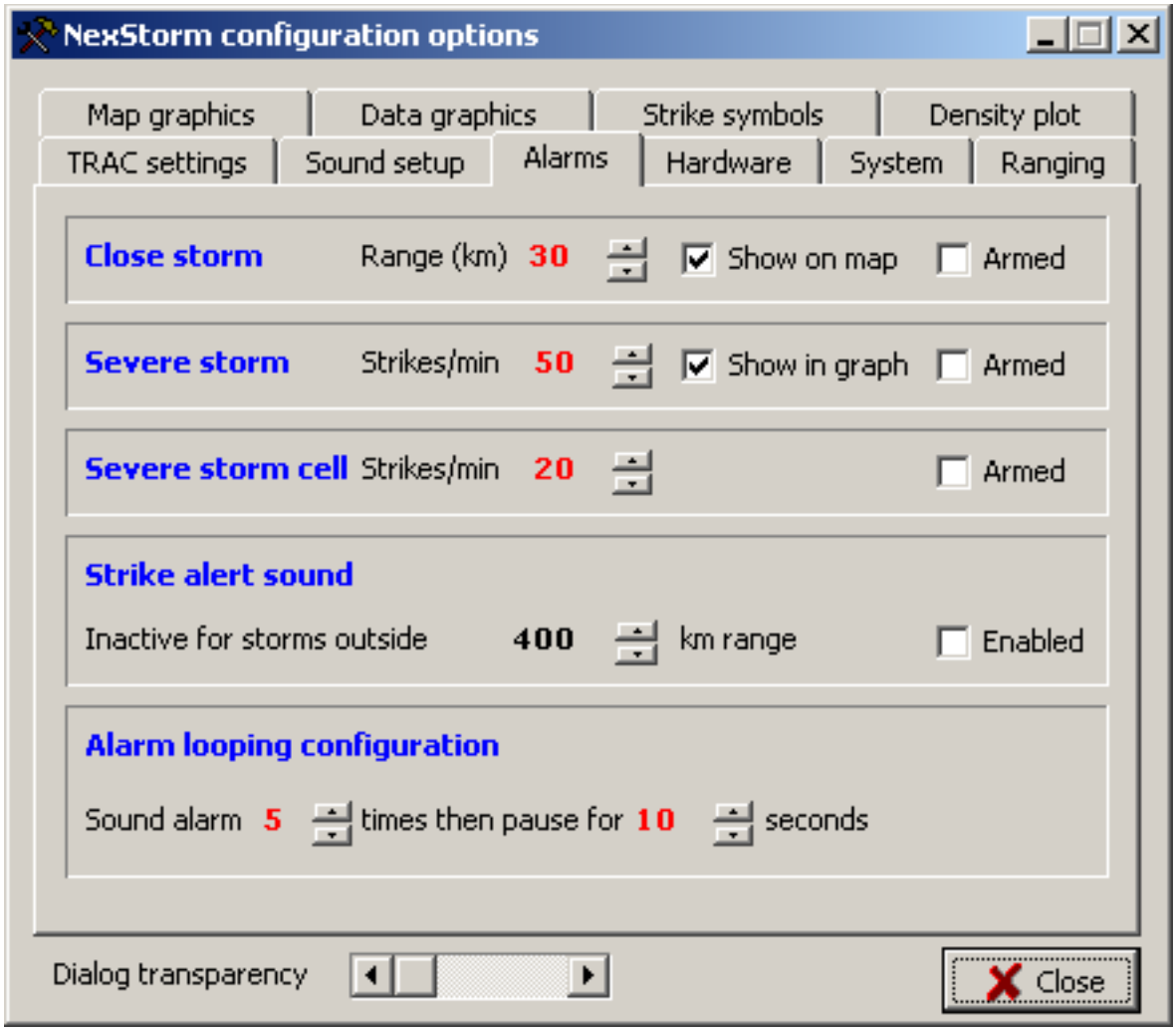

Figure 10. Alarm configuration tab

Alarm types
NexStorm provides you with three different types of alarms:

Severe storm alarm	Triggered by a configurable strike rate set by the user.
Close storm alarm	Triggered by a TRAC targeted stormcell being at or inside of an adjustable range.
Severe storm cell alarm	Triggered when a TRAC stormcell's strike rate goes above the user adjustable strike rate parameter.

The Severe and Close storm alarm triggers can be shown in the main user interface window by checking the Visible on map and Visible in graph checkboxes respectively.

Additionally, strike and noise alerts can be deactivated for events that occur outside a specific distance by enabling the *Inactive for storms outside...* option.

Alarm looping configuration setting
When an alarm is triggered, its associated sound (whether played using the PC-speaker or wav-sound) will be played the amount of times that is configured under the Alarm looping configuration setting. The *pause* parameter tells NexStorm how many seconds it should wait between playing consecutive alarms.

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Hardware tab

Receiver type and hardware port address
Before you can use NexStorm for detecting lightning you must configure it for the type of Boltek detector that is installed on your system. NexStorm supports both the older ISA type detector as well as the newer PCI type detector and the LD-250 portable detector. Select which type you are using by checking the appropriate radio button under Receiver type.

If you are using an ISA card detector with a non-standard hardware port address, you can assign the appropriate address in the ISA card port address edit box. Note that the address must be given in hexadecimal number format. Press the Enter button to commit the change and to allow NexStorm to verify that the number you provided was a valid hexadecimal number.

If you are using the LD-250 detector, make sure to select the appropriate serial port before enabling the receiver.

Antenna alignment
The Antenna alignment feature allows you to mount your StormTracker antenna in any direction as the deviation from north can be fully compensated for by adjusting the alignment parameter. The Reverse (X-Y swap) switch must be used if the antenna north has been mounted pointing somewhere towards the south, in essence between bearing 90 and 270.

When you have made your adjustments, the figure within parenthesis above the adjustment slider will show the direction in degrees that your antenna is physically pointing to.

Examples:

Antenna direction	Adjustment	Reverse (X-Y swap)
360 degrees	0	unchecked
180 degrees	0	checked
315 degrees	North -45	unchecked
225 degrees	South +45	checked

Table 2

Note!
The adjustment you make here will not be stored in the archived data. Archived strikes are stored without any regard to the Antenna alignment adjustment setting.

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Receiver settings
Allows you to set the StormTracker receiver squelch and to adjust the Noise sensitivity filter.

High squelch settings (above 4) will cause many weak signals to be filtered out by the receiver and should be avoided as it will affect the precision of strike ranging and TRAC. If you have a signal pollution problem with a substantial amount of false strikes being plotted on your map, you should first and foremost try to locate and eliminate the source of the false signal emissions.

The Noise sensitivity filter can be used to increase or decrease the amount of signals that are classified as noises.

A setting of *Low* or *Very low* will allow more signals to be classified as strikes while a setting of High or Very high will filter out more signals as noises. Use this setting with caution, lowering it might in some cases allow for better ranging in general but could in other cases interfere with the ranging process and make it unreliable.

Setting the Noise filter to *High* or *Very* high might in some instances alleviate problems with false stroke signal sources in your vicinity although the higher noise filter that is used, the higher percentage of actual strike signals will be discarded as well. The best way to determine which setting to use with your StormTracker installation is through experimentation. Leave this setting at *Default* if you are not sure of which one to use or if you don't have any problems with false strikes.

Receiver activation
Check this checkbox this if you want NexStorm to automatically enable the StormTracker receiver when the program is started.

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System tab

The System dialog provides you information about NexStorm memory usage, free disk space on the drive where NexStorm is installed and allows you to adjust a few parameters related to the application's performance and behavior.

Archive maintenance – Autoclip
If you expect severe weather - enable this feature! The clipping of archives is used for keeping file sizes of the currently used daily archive to controllable levels. With Autoclip enabled, the archive will be split into manageable parts sized 4 MB each. Enabling this feature will greatly improve performance on all systems once the archive starts growing. After a clip is performed, the part that was clipped will be renamed with a sequential digit appended to its filename, i.e. 20030425_1.nex, 20030425_2.nex and so on. The counter data in each archive will be valid up to the point the archive was clipped. The daily archive that was last used, hence not renamed, will contain counter totals for the entire day.

You can at any time perform an immediate clip on the archive by pressing the Clip now button. This will clip the archive without regard to its size so avoid performing this operation frequently.

Archive maintenance – Move after completion
This feature allows you to move a completed archive to another location on the same hard drive. Normally you would create a subfolder in the NexStorm installation folder and configure this feature to move completed archives to this location.

Daily archives are finalized at midnight each day and it is after this point in time that they will be relocated.

Don't forget to select which folder to use as the archive storage by pressing on the *Directory* button and selecting a folder or this function will not have any effect! Note that NexStorm will only move the previous day's archive if it is allowed to run past the point at which date change occurs.

Archive maintenance – Do not archive noises
Enable this option if you are not interested in archiving noise data. Not archiving noise data will render smaller archives so this setting is particularly useful if your setup has intermittent noise problems which would cause the program to store a lot of garbage data in the archives. ***You should strive for as noise-free environment as possible when mounting your lightning detector antenna! Even moderate amounts of false electro-magnetic signals (showing as strikes and/or noises on the NexStorm display) may adversely affect ranging accuracy.***

NexStorm VM Usage, System status, Memory Status and Internal memory buffer.
The virtual memory usage setting (VM) controls how much system memory NexStorm will allocate to store its strike data in. All strikes and noises are stored into a memory buffer, the VM usage setting controls how much system memory this buffer will use.

You can see how many strike records will fit into the buffer with your current VM usage setting by looking at the Memory status/Reserved space entry. The amount of kilobytes these records occupy is visible directly below. The percentage of virtual memory used is visible in the System virtual memory usage bar, this should correspond to the setting you chose for VM usage.

You can also see how much of the entire buffer is currently being used by looking at the NexStorm buffer usage bar.

Once the memory buffer is full, NexStorm will begin recycling it. The oldest strikes will be removed from memory and new strikes will be put in the buffer in place of older ones. A buffer usage of 100% is in other words nothing that will stop NexStorm from running, it just means that the entire allocated buffer has been populated with data and is a perfectly normal situation. Old strike data is always saved to the archive so you will not risk losing any data even when the buffer is filled to capacity.

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You can adjust the VM usage between 5 and 20 percent. It is recommended that you adapt this setting to the amount of memory you have installed on your system. 5 percent is recommended any time your installed RAM is less than 128 MB. This setting will affect performance on low end systems, if you are running anything slower than a 500 MHz processor you should reduce the buffer allocation to a minimum. After you have made adjustments you will need to restart NexStorm for the new settings to take effect.

Internal memory buffer information holds information about the purging of the memory buffer. Every once in a while, NexStorm will clean out the buffer of strikes that are older than the maximum persistence setting of 300 minutes. As these strikes cannot be displayed anyway, there is no need to keep them stored in memory. Purging will improve performance by allowing NexStorm to iterate through a smaller amount of records when plotting strikes on the map as compared to if the buffer was not purged. You can see at what time the buffer was purged and when the next purge will occur. After a purge has been done, you should see NexStorm buffer usage decrease a bit, the amount will depend on the number of records that were purged.

Lastly, keep a watchful eye on the Disk usage bar. This indicator shows you how much space is used on the hard drive unit where NexStorm is installed. If the disk starts becoming full, the bar will turn yellow to alert you of this. At this point you should seriously consider removing unused files to free up disk space, NexStorm will not be able to run if it has insufficient disk space for storing its data.

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Ranging tab

Under this tab you can adjust all of NexStorm's non-segmented ranging functions. There are four range modifiers that can be used independent of each other, which ones you should use depends on the type of ranging calibrations that you need to make.

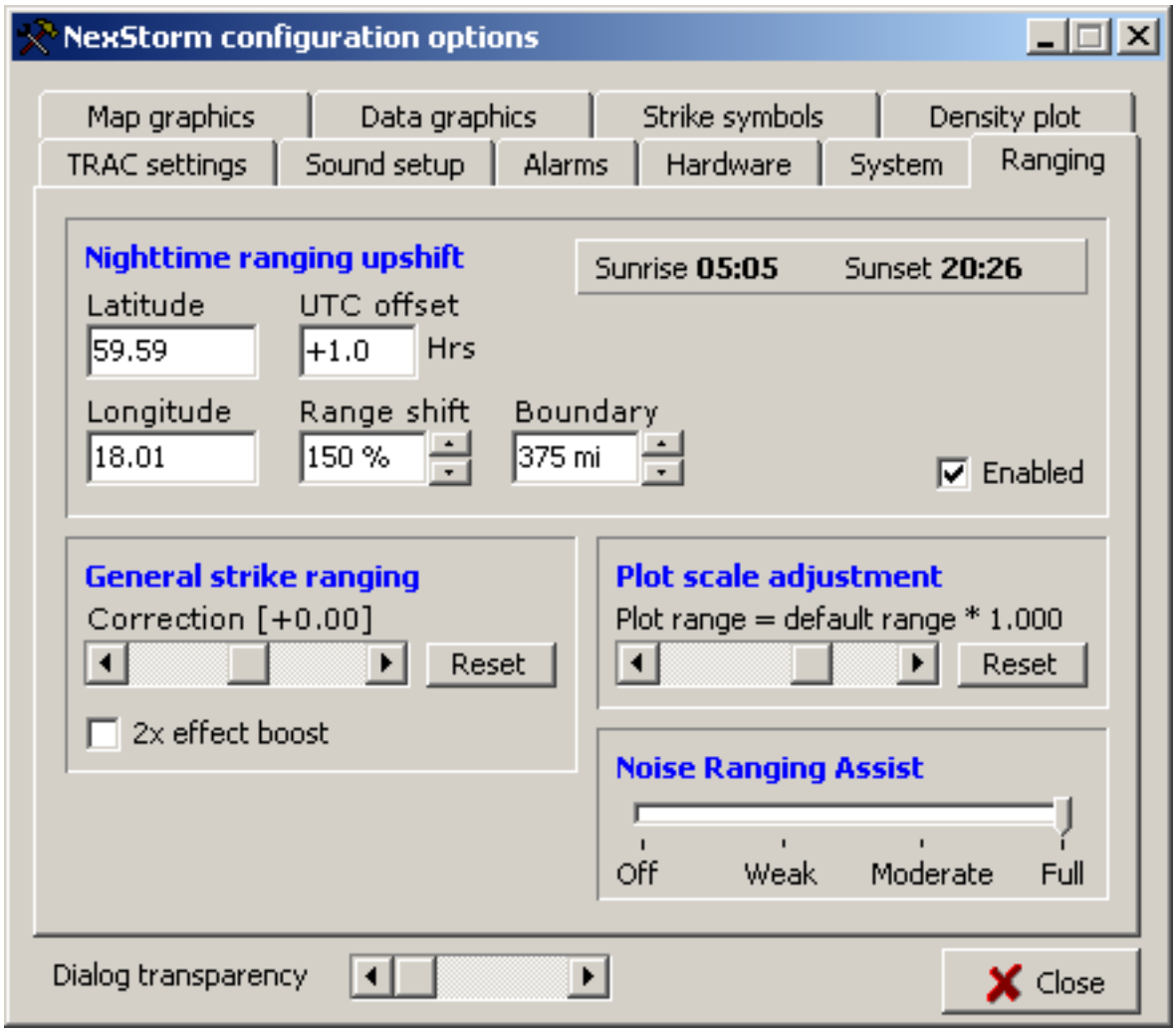

Figure 11. Ranging configuration settings

Nighttime ranging upshift
This function will change ranging of strikes upwards by the specified percentage and starting from the specified distance but only during night!

Nighttime ranging upshift utilizes a sun position calculator. In order for this feature to activate and deactivate at the correct times you have to enter your location's Degrees Decimal latitude, longitude and UTC standard time offset. Once these parameters are set and *Enabled* is checked, the sunrise and sunset times will be displayed in the upper right corner of the panel with Daylight Savings Time (DST) automatically adjusted for.

Note!
During replay, Daylight Savings Time cannot be computed for the date of the archived data. To override the default (todays) DST state, open the Replay setup dialog (green arrow in the replay control dialog) and select or deselect DST. When first opened, the DST Override setting will be enabled or disabled depending on if DST is active for the current day.

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Why differentiated night time ranging is useful

Lightning detectors such as the Boltek StormTracker and LD-250 are subject to radio signal propagation laws. When a lightning strike occurs it will emit an radio signal pulse, a wave, that will propagate towards the detector antenna both as a ground wave and a sky wave. A sky wave is basically a wave that was “bounced off” the Earth's ionosphere at least once. This will enable the wave to propagate much further than it would if it were a ground wave.This phenomenon is well known among amateur radio enthusiasts, enabling them to communicate across great distances when conditions are favorable.

The ionosphere consists of several layers called D, E, F1 and F2, where the D-Layer will absorb sky wave signals in certain frequencies during daylight hours. The F1/F2 layers, commonly referred to as the F-layer, is in effect reflecting these waves, bouncing them back towards earth with minimal attenuation. Shortly after the sun sets, the D-Layer will begin to dissipate and this will allow the higher F-layer to reflect those waves that were previously being absorbed by the D-Layer. Under certain conditions and especially during night time hours, lightning signals from very distant thunderstorms can therefore “sky-hop” their way to your antenna by bouncing between the F-layer and the ground one or more times. This is generally not a problem during the day because the majority of the lightning signals are ground waves, the sky waves being effectively absorbed by the D-layer.

Occasionally you may therefore observe more or less well defined storms appearing relatively close to your location while the actual thunderstorm that is generating the lightning is located much farther away, often outside the range of the map. If you see this phenomenon then the most probable explanation is that the atmospheric conditions are favorable for sky wave propagation

The Nighttime ranging upshift can partially or fully compensate the incorrect ranging that occurs with some of these distant thunderstorms but you should not expect it to be accurate all the time. The NexStorm ranging formula becomes more error prone at greater distances because of the reduced amounts of captured lightning signals, but there are also other factors which will influence the performance of the Nighttime ranging upshift feature, such as daily and seasonal variations in atmospheric conditions and/or surrounding terrain.

The ranging upshift will activate at sunset and gradually be applied until full effect is reached around 30 minutes after initial activation. Similarly, after sunrise, the upshift effect will be gradually reduced and reach minimum/switch off level after around 30 minutes. If the latitude, longitude and UTC offset are all set correctly, the times at which Nighttime ranging upshift activates and deactivates will correlate rather well with the dissipation and formation of the D-Layer.

Note!

The optimal values for *Range shift* and *Boundary* will be different for different locations but may also vary for the same location on different days.

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General ranging correction
Allows you to adjust how individual strikes should be ranged by NexStorm. The General ranging correction is a weighting modifier, that is, by adjusting it the TRAC sub-process will be “nudged” or biased to range storms towards the direction of the applied adjustment.

Negative values means that strikes will be ranged closer to the center, positive values means strikes will be ranged farther away. The ***2x effect boost*** will double the power of the ranging adjustment and can be used if you find that the default maximum or minimum setting is not sufficient for your calibrations. Note that there is also a separate 2x effect boost provided in the Segmented Ranging Correction

The General ranging correction is omni-directional, changing it will affect strike ranging in all directions. Strikes that occurred before an adjustment was made will not be affected. To see the effect on TRAC targeted stormcells you must allow the program to process some 30 or more strikes per target before the adjustment you did will have any impact on the storm distance. For this reason it is better to use the Replay for calibration work using General ranging correction as you then can speed up the whole process.

Remember to have a great deal of patience when making ranging calibrations! These kind of adjustments can take several months to get perfect and even then you can not expect every single storm to be positioned accurately. Instead of making calibrations using real time data, make notes of how and where storms are ranged good or not so good and then use the Replay function at a later time to make your calibrations – it will save you a lot of time!

Use the General ranging correction in conjunction with the Segmented Ranging Correction to achieve optimal ranging. The Segmented ranging allows you to adjust ranging for 8 separate sectors and should be used where environmental circumstances require differentiated directional ranging. One example of such an circumstance is having large bodies of conductive salt water to the south of your location while land to the north. In this particular case, storms originating in the south lobe of the detector coverage will in many cases be ranged closer than they actually are.

Plot scale adjustment
This function will change the strike X-Y coordinate to map scale ratio. Plot scale adjustment is a high-level graphics function with immediate effect, sliding the plot scale slider back and forth does not affect the ranging algorithms (contrary to the General ranging correction) and the result can be instantly seen on the map. Setting the plot scale adjustment to values above one will move strikes and storms farther from center, values less than one will move them closer. It is easy to calculate the new distance by simply taking the current distance of a storm (or strike) and multiplying it with the new Plot scale factor.

Why two different ranging adjustments that seemingly work the same way?
Although superficially the General ranging correction and Plot scale adjustment appear to be doing the same thing, they do it in different ways yielding slightly different results. Each method has its advantages and disadvantages as described below.

The Plot scale adjustment is instant but will modify the shape of a storm cluster by radially elongating it. This problem gets worse the more you scale the range upwards (values > 1.0). Similarly, for downscaled ranges the storm clusters will become more compacted although this is not as evident as the radial elongation that occurs with upscaling. The reason for this behavior is that when you adjust the Plot scale, you are also modifying the radial distance ratio of the area (i.e. the map) where strike and storm data are being plotted.

The General ranging does not exhibit the radial elongation or compacting problem but is on the other hand more complicated to adjust properly since you are not modifying existing strike and storm positions, but rather instructing NexStorm which way to nudge, or bias, ranging. Another drawback with General ranging correction is that it will take a much longer time for the adjustment to take effect. Depending on the strike rate of a storm it can take anywhere between 5 and 30 minutes before you see the effects of your change. Generally you should use Plot scale adjustment if you need to make smaller corrections frequently or during calibration work when you want to estimate how much General or Segmented ranging needs to be applied. After transferring the required Plot scale change to either one of the other two available ranging functions, it should be reset to zero.

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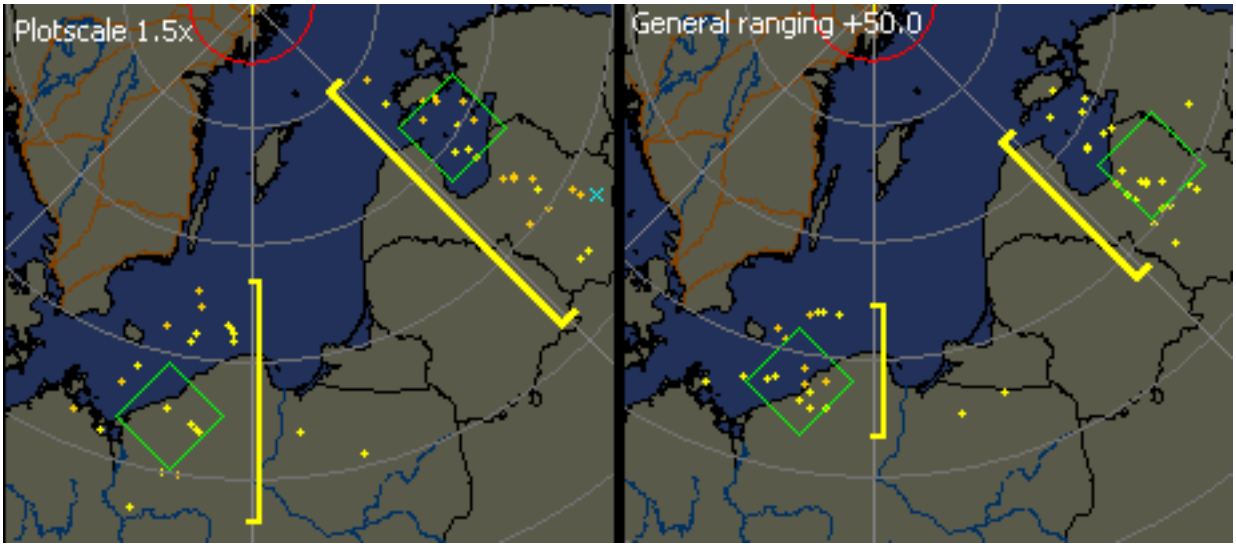

Figure 12. Radial elongation example. Note how the radial length of these two storms varies depending on which ranging adjustment method is used

Noise Ranging Assist

During nearby thunderstorm activity and where the environment around the detector is free from interfering noise signals, a series of noises immediately preceding a valid strike will in most cases indicate that initiating portions of a strike were captured by the detector (related intra-cloud component, stepped leader etc). The Boltek detector is capable of detecting these relatively weak electro-magnetic signals at close range but determining the direction of such an event can be difficult and they are therefore often classified as noises.

If such a noise pattern is detected by NexStorm, the program will utilize it to produce a better estimation of the distance to a co-incidental strike. The Noise Ranging Assist has four effect levels where *Full* is the default setting. If you notice that ranging of close storms is too much biased towards center, try lowering the Noise Ranging Assist gradually until ranging becomes more accurate.

The Noise Ranging Assist function is vital for achieving accurate close storm ranging and should only be disabled if you are having serious noise problems with your detector! It is imperative that you make sure that your lightning detector is not picking up continuous noises from artificial sources such as electrical equipment. If you find that you are unable to use the Noise Ranging Assist feature then this is a good indicator that relocating your antenna might be necessary. Alternatively, you could try to find and eliminate the noise source that is causing your problems.

Note!

Occasional noise indications of 1 per minute or less frequently does not affect the performance of Noise Ranging Assist.

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TYPE DIFFERENTIATED STRIKE RATE GRAPH

The NexStorm strike rate graph can be configured to display historical strike rate data in several different ways. The graph is type differentiated, which means that the different strike types can be represented using separate graph plots, and persistent which means that the graph data is saved to disk and will persist through software restart.

Time scale
The graph can be configured to display different time intervals, ranging from 0-15 minutes and up to 0-120 minutes. The graph granularity (time resolution and display refresh rate) is 20 seconds.

To change the time scale, press F1 to increase or F2 to decrease.

Strike rate scale
The scale which indicates the strike rate is scaled automatically. The lowest possible range on the vertical axis is 0-30 strikes per minute. The upper bound is infinite.

Graph smoothing
The different graphs can all be smoothed by applying a Laplace 5-pass smoothing algorithm. The difference between a smoothed and non-smoothed graph is illustrated in fig.13 where identical graph data is shown with and without smoothing applied. A side by side comparison of an equivalent stacked graph is shown in fig.16.

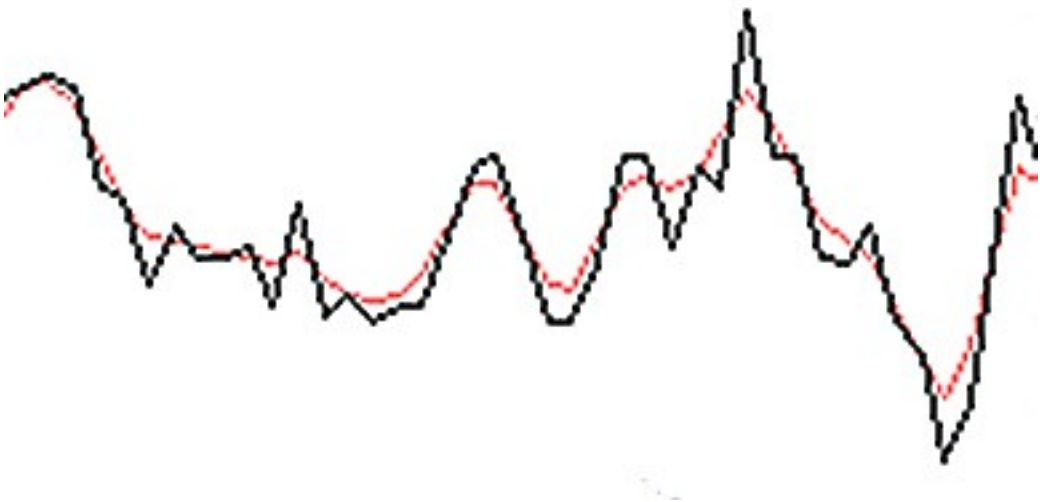

Figure 13: Non-smoothed (black) and smoothed (red) graph comparison

As is evident in fig.13, graph peaks will be smoothed out so that the peak strike rate shown in the graph will in most cases be lower than indicated by the numerical peak strike rate indicator. Smoothing is used to improve the visualization of strike rate data but will on the other hand make the graph less accurate. If accuracy is important then using smoothing should be avoided.

To toggle graph smoothing, press the F3 key or select the corresponding option from the *Trend graph* menu or the *Data graphics* configuration dialog.

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Graph modes
The graph has two different presentation modes which makes it possible to display strike rate data in slightly different ways.

Normal mode
In normal mode, each graph will be plotted so that the strike rate value correctly matches the scale indicator.

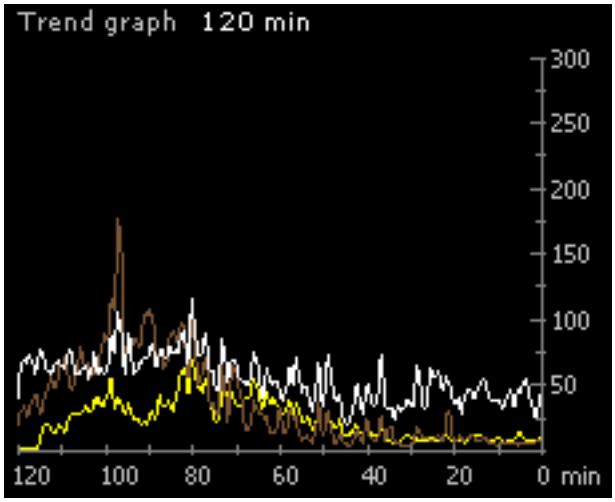

Figure 14: 120 min normal mode graph, showing total and close strike rates, and noise rate

Similarly to a stacked mode graph (see below), a normal mode graph also has the capability to show differentiated strike rate data. For longer time series, differentiated graphs in normal mode can turn out to be less useful because the graph may become cluttered and difficult to read.

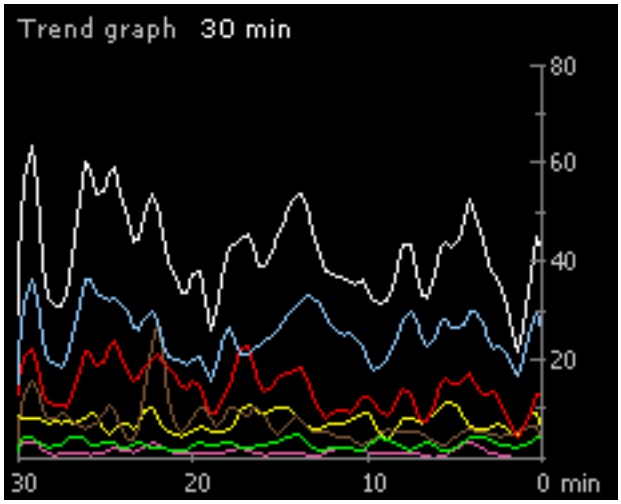

Figure 15: 30 min differentiated, smoothed normal mode graph

Graphs available in normal mode:

- Total strike rate
- Close strike rate
- Noise rate (optional)
- +CG, -CG, +IC and -IC rate (optional, not available with LD-250)

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Stacked mode
In contrast to the normal mode graph, the stacked mode graph is used to more efficiently present the relationship between strike type specific strike rates. Here, each graph is plotted so that it represents the aggregate value of its own data set and all of the data sets beneath.

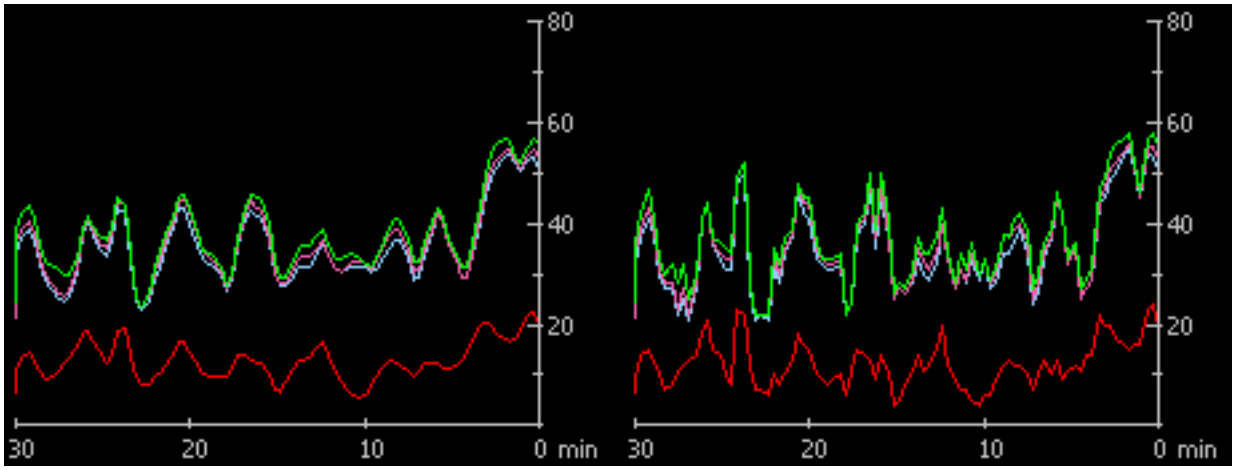

Figure 16: Side by side comparison of a 4-hour stacked graph without (left) and with (right) smoothing

In stacked mode, the topmost graph is the one that will show the total true strike rate. To obtain the actual strike rate value for an individual graph you must subtract the strike rate values of all the graphs beneath it.

Stacked mode is particularly useful for observing changes in polarity and strike type distributions in thunderstorms over time.

Graphs available in stacked mode:
- Stacked +CG, -CG, +IC and -IC rate

Note!
The stacked graph mode and differentiation is **not** available with the LD-250 detector!

To toggle between normal and stacked mode, use the F4 key or select the corresponding option from the *Trend graph* menu or the *Data graphics* configuration dialog.

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USER INTERFACE POP-UP MENUS

There are two pop-up menus available directly under the user interface. The first one is accessed by hovering the mouse pointer anywhere over the map window and clicking the right mouse button. This menu contains a number of shortcuts to help you configure your map window display and presentation of data.

The second pop-up menu is accessed by right-clicking on the *Range* label or the current range indicator to the right of this label. This action will bring up the *Quick zoom* pop-up menu which allows you to select a specific view range instantly instead of having to step through a number of zoom levels using the Insert or Delete keys.

Map pop-up menu

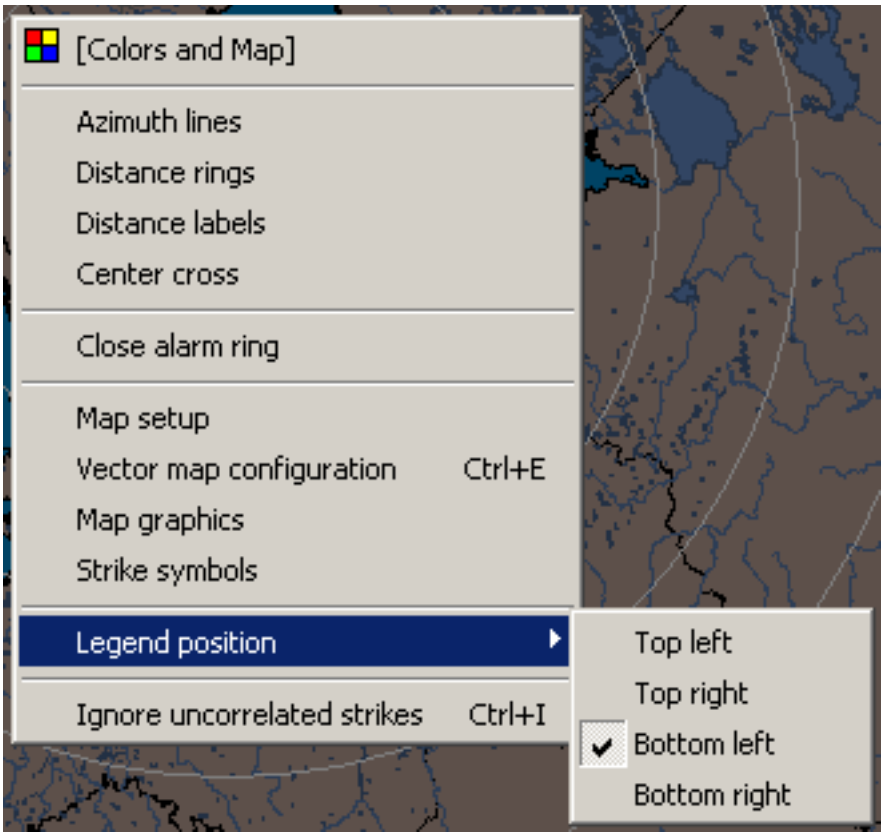

Figure 17. Map pop-up menu

The first 5 entries in this menu will open a color picker dialog if clicked. Use this to change the respective colors of the various map overlay components.

Map setup will open the map assignment dialog and is equivalent to selecting NexStorm->Map setup from the main menu or pressing Ctrl+M.

Vector map configuration opens the dialog where you can change the colors of CVM map layers, hide or display the different available layers or recenter the CVM map center. Accessing the vector map configuration can also be done by pressing Ctrl+E

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Map graphics and **Strike symbols** will open the main configuration dialog with the respective tab already selected. This is equivalent to pressing Ctrl+C and then clicking one of these tabs.

Legend position allows you to position the strike symbol legend in one of the four corners of the map window.

Ignore uncorrelated strikes toggles the plotting mode between showing and hiding uncorrelated strikes. You can also change this setting in the Configuration dialog, TRAC Settings tab.

Quick zoom pop-up menu

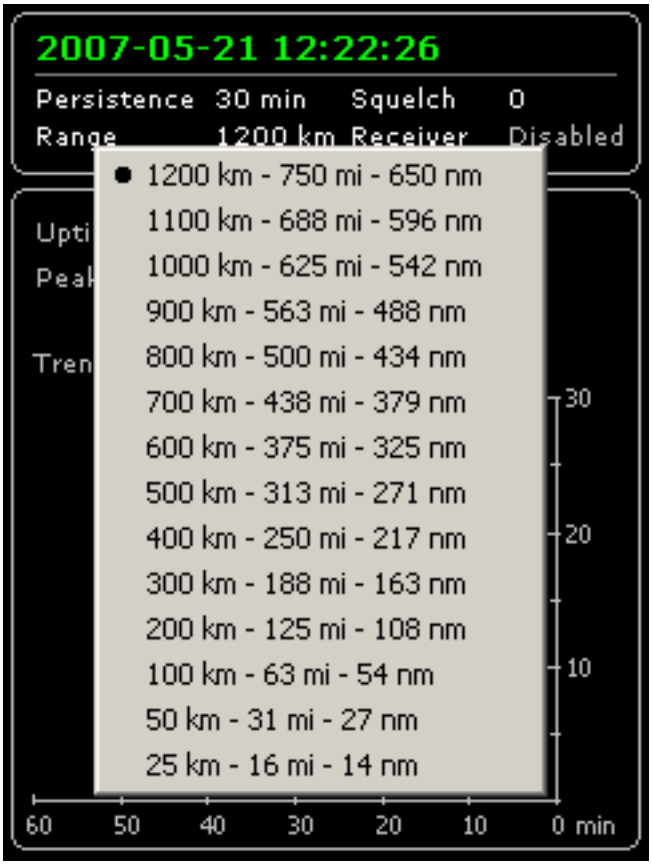

Figure 18. Quick zoom pop-up menu

Right-clicking on the *Range* label or the adjacent current range indicator label will bring up the Quick zoom pop-up menu. Select which range to zoom in to by clicking one of the available ranges in this menu. The currently selected range will be checked as can be seen in the above screenshot.

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VECTOR MAP CONFIGURATION

Note!
This section of the manual only applies if you have purchased and installed a Composite Vector Map. To obtain a custom CVM map for you location, please visit our website or contact us by email.

Later NexStorm versions support a new vector map format called CVM. This section describes the new *Vector map configuration* dialog that is only accessible when a CVM map has been loaded.

The procedure for assigning a CVM map to NexStorm is exactly the same as for the regular BMP format maps. Once assigned, pressing Ctrl+E or selecting Vector map configuration from the map window pop-up menu (click the right mouse button while the mouse pointer is hovering over the map) will bring up the dialog shown in figure 10.

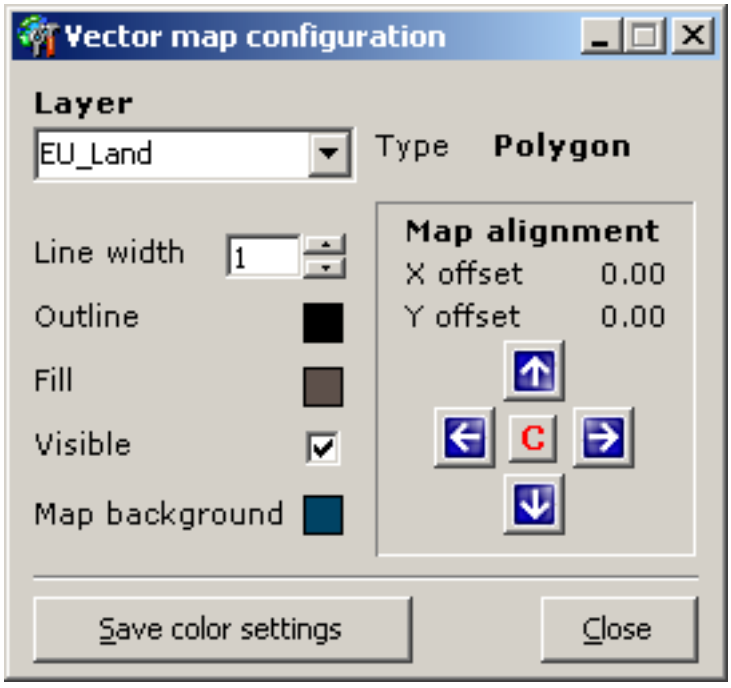

Figure 19. Vector map configuration dialog

The CVM map is layered, this means that there are several separate geographical data objects all packed in the CVM file, for instance country borders, state boundaries and county boundaries. A layer can be either polygon based or polyline based and each layer has its own color settings. Polygon based layers have separate outline and filling colors while a polyline layer consists only of lines so there is only one color that can be altered.

Normally, country boundaries are polygon based while highways, state and county boundaries are polyline based. The *Type* label in the Vector map configuration dialog will indicate which type the currently selected layer belongs to.

The following page describes each of the available vector map configuration options.

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Vector map configuration dialog breakdown

Layer: Allows you to select which of the available layer you want to work on.

Line width: Sets the outlining line thickness for the layer that is currently bing shown.

Outline: The outline color used for this layer. Click inside the color box to change the color.

Fill: The fill color used for this layer. If the layer type is polyline, the fill color box will be dashed indicating there is no color that can be modified

Visible: Check this option if you want the currently selected layer to be hidden, i.e. not drawn on the map.

Map background: Click inside the map background color box to change the background color used.

Type: Label displaying what type the layer currently is, polygon or polyline

Align map: If you need to adjust the map center, use the arrow buttons to move the map in one of four directions. The closer you zoom in on the map, the more precise will the movement become. To reset any alignment that has been made, press the center button with a red ‘C’ on it.

Save color settings: Press this button to save any color changes you have made. Note that the CVM map is self-contained in regard to its data so ***any changes you make will be saved directly to the CVM file!*** For this reason it is strongly recommended that you make a backup copy of your CVM map before you start modifying its color settings.

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REPLAY

The replay feature is used not only for replaying older archives in NexStorm, it is also an excellent tool for ranging calibrations. Despite the name of this feature it does not replay the archive in the true sense of the word. Instead, while you are replaying, NexStorm actually reprocesses each strike in the archive, using its raw data component as the source for computation. It is very much comparable to your Boltek StormTracker hardware receiving a strike that is then processed by NexStorm, only with replay, the signal arrives from the archive. For this reason, replaying the same archive twice, will produce similar but rarely identical results.

Before we go through the available features in replay you should note that during a replay session, the file upload and file copy features will be blocked from operating. The screenshot feature will remain available in either real-time or replay mode and the real-time capturing of strikes will keep running in the background until you exit replay. Automatic TRAC Report generation will be disabled during replay, you can however at any time during replay press the Save button in the TRAC Report dialog to generate a report based on the replayed data. The real-time TRAC data is kept in memory until you exit replay.

The replay panel
Open the panel through the menu NexStorm->Replay or use shortcut keys Ctrl+R. Note that NexStorm will not enter replay mode until you actually load an archive, just opening the replay panel has no visible effect on the real-time capture. You will be able to see the switch between modes by looking at the NexStorm system clock, a capital 'R' is always visible after the time when the replay mode is made active.

Figure 20. Replay panel

There are 8 buttons on the replay panel that are used for immediate replay control. The buttons are (from left to right in figure 11):

1. Open archive
2. Rewind to start time
3. Stop
4. Play
5. Increase replay speed
6. Decrease replay speed
7. Toggle archive activity graph
8. More options

Button 8 - More options will open separate dialog where you can configure looping, replay start and stop times and switch Daylight Savings Time or set NexStorm to replay and loop the archive currently in use (i.e. archive of today).

Archive activity graph
This is a graph that shows you the distribution of activity in an archive that you are about to open. It will additionally display the amount of records (strikes and noises) that the archive contains, the distribution between the various types of records and when the first and last events (strike or noise) were captured. In the graph you will be able to see how the strike rate fluctuates during different times of the day and you can use this to easily locate a time of interest to replay specific parts of the archive.

The graph is activated when the Open archive button (1) is pressed and is populated with data when a valid NexStorm archive in the open file dialog is highlighted. Once you open the archive, the graph will close. You can reopen the graph at any time while in the replay mode by clicking the Toggle archive activity graph button. This button toggles the activity graph between visible and hidden.

Opening an archive for replay
Click on button 1 (with a folder icon) in the replay panel. A file dialog will open along the archive activity graph. When you highlight an archive that contains some data you should see, the archive activity graph becomes populated with information. To open this archive, click on Open in the open file dialog or double-click on the archive file. Once the archive is loaded you should see its name above the Open archive button.

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Replaying an archive
You can immediately start replaying the archive by clicking on the Play button (4). The replay start-time is automatically set to begin replaying from the first recorded event in the archive but since a lone strike or noise early in the morning hours will affect this setting, you should initially adjust the start-time lightly before the real actions begins. To adjust the start and stop times, click on the More options button (8). Set the desired start and/or stop time and check the checkbox “Loop replay” if you want NexStorm to keep replaying this archive indefinitely. Note that if you are in the middle of replaying an archive and click on the More options button, the replay will be halted.

Use the archive activity graph to pinpoint where in the archive the action can be found and adjust the replay start and stop times accordingly.

The Rewind button (2) will reset the replay to whatever time you have set the start-time to.

The Stop button (3) will halt the replay until you press Play (4) again.

Adjust replay speed up or down using buttons 5 and 6. You can see the current replay speed right above the speed setting buttons.

Note!
Maximum replay speed is 1024x which equates approximately 17 minutes for each passing second while the replay is running. You should be aware that, depending on the intensity of the storms that are being replayed and the computer you are using, very high replay speeds will adversely affect the NexStorm performance in general. Users with low end systems should in all cases avoid using excessively high replay speeds.

To replay and loop today's archive’s last 30 or 60 minutes, click the More options button and press the appropriate button. This particular feature in the replay will replay the last 30 or 60 minutes of today's archive, then reload the latest captured data once it has played the archive to the end.

You may also replay the currently used archive by opening it like any other older archive but you will not have the option to set the start and stop times. This feature is only available to allow viewing data captured prior to the last 60 minutes. To be able to replay today's archive with time control, make a copy of today's archive and replay the copy instead. You do not have to disable or restart the program in order to make a copy, NexStorm does not continuously lock the archive file while running.

To adjust ranging with the replay, refer to the Ranging adjustment section of this manual. The procedure for applying ranging correction is identical irrespective of which mode you are in, replay or real-time.

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TRAC REPORT

Thunderstorm Ranging and Acquisition

Thunderstorm Ranging and Acquisition, or TRAC for short, is a sub-process in NexStorm that contains all the logic behind computing where thunderstorms are located and analyzing their characteristics. TRAC can also produce a text-based report based on its findings to show you details about individual storms. The TRAC related On-map ident feature uses TRAC data to display important information about a thunderstorm in coded format directly on the map. If the On-map ident is enabled, each storm will have a tag attached to it, this tag will show you the storm's identification number, its polarity, current strike rate and the strike rate trend over the last few minutes.

When TRAC has detected what it believes to be a structured thunderstorm system, it will start tracking it until the storm dissipates or the tracking could not be maintained for other reasons.

Targets

A tracked thunderstorm is called a target and the location of each target will be drawn on the map if the Plot TRAC targets feature is enabled (see Configuration). Targets can have different colors depending on the intensity of the storm being tracked. The symbols and colors that are used for drawing targets on the map are to some degree user configurable. The intensity level and the corresponding default color setting are described in table 3.

TRAC Target colors and intensities

Color	Strike rate/min	Classification
Green	1-10	Weak
Yellow	11-49	Moderate
Red	> 50	Strong or Severe

Table 3

If two targets collide, they will merge. The least active target will in that case become a part of the more active one. The 20 minutes trend parameter will be reset at that point to allow for recalculation of the new storm's actual intensity level. Strikes that fall near a target are instantly coupled with it, these strikes are called correlated. Strikes that fall too far away from any target are classified as uncorrelated.

Note!

Storm severity classification is a function of the inverse distance to a thunderstorm so the figures shown in tables 3 and 4 will not apply for storms located at a farther distance. The figures presented here are based on “ideal” storms that are within 150 km range (93 miles). The more distant a storm is, the lower the strike rate will be required for upgrading its severity classification.

TRAC Report

TRAC will periodically generate a report based on current activity. This report can be viewed in tabular format from within NexStorm by opening the TRAC Report dialog (Ctrl+T).

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TRAC Report dialog
While a thunderstorm is being tracked it is also being continuously analyzed. You can view the results of the real-time analysis in the TRAC Report table. The table contains the following data fields:

Ident	Identification code, a letter followed by a dash and one or more digits.	
Detected	Time when the storm was first detected.	
Bng	Bearing to storm target.	
Dist	Distance to the storm target (units are according to the Map graphics configuration).	
Active	Time of last recorded activity.	
Intensity	Intensity classification (also see color of this particular table row) can be:	Weak Moderate Strong Severe
Trend	Rate per minute trend over the last few minutes, can be:	Undetermined No change Increasing Decreasing
Rate/m	Last recorded strike rate.	

To view the peak strike rate, accumulated totals and strike distribution details for a specific storm, click on the row of interest in the report table, the area below the table will then be populated with additional data.

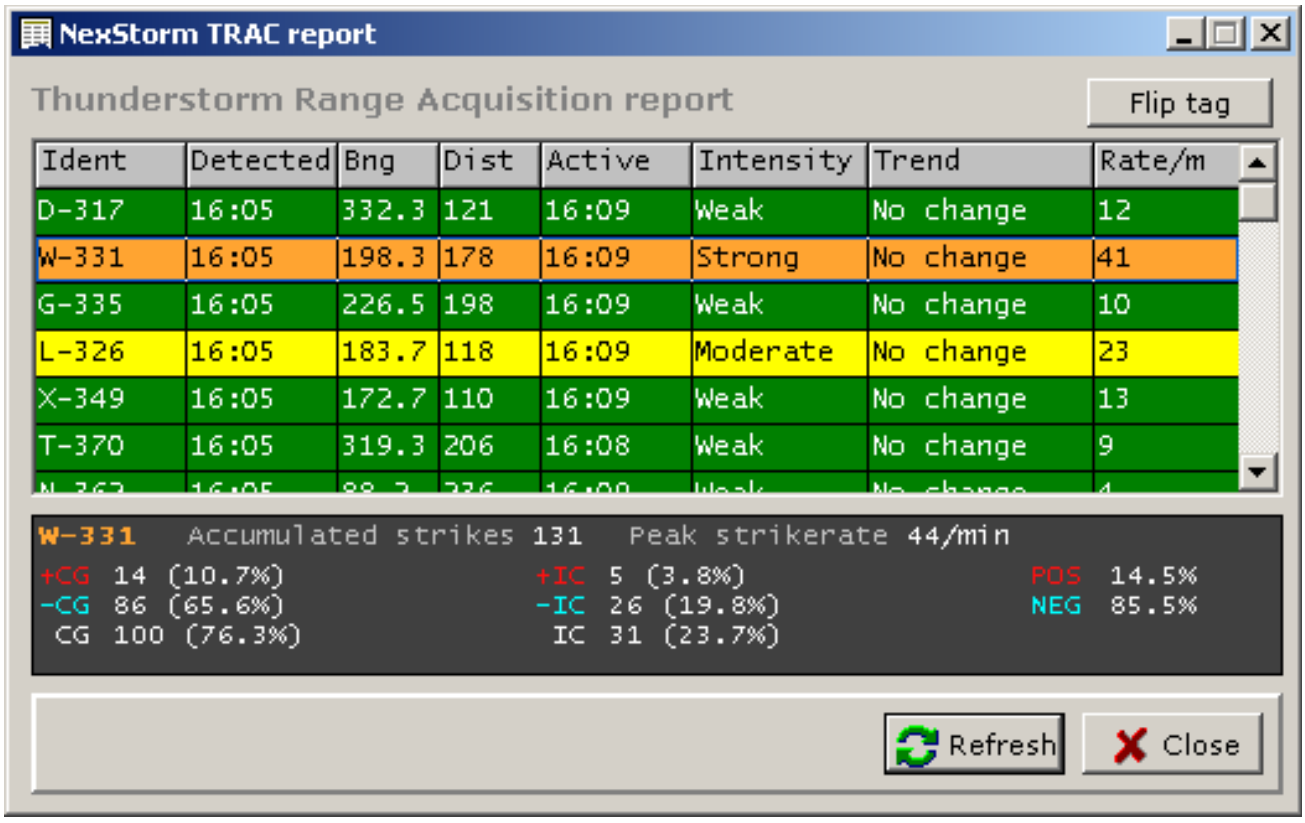
NexStorm TRAC report
Thunderstorm Range Acquisition report
Flip tag
Ident Detected Bng Dist Active Intensity Trend Rate/m
D-317 16:05 332.3 121 16:09 Weak No change 12
W-331 16:05 198.3 178 16:09 Strong No change 41
G-335 16:05 226.5 198 16:09 Weak No change 10
L-326 16:05 183.7 118 16:09 Moderate No change 23
X-349 16:05 172.7 110 16:09 Weak No change 13
T-370 16:05 319.3 206 16:08 Weak No change 9
W-331 Accumulated strikes 131 Peak strikerate 44/min
+CG 14 (10.7%)
-CG 86 (65.6%)
CG 100 (76.3%)
+IC 5 (3.8%)
-IC 26 (19.8%)
IC 31 (23.7%)
POS 14.5%
NEG 85.5%
Refresh
Close

Figure 21. TRAC report dialog with storm W-331 highlighted

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Each row with contents in the TRAC Report dialog table will be colored accordingly to indicate the intensity of a storm, similar to the target symbols. Contrary to the TRAC target symbols however, the report table has the ability to distinguish between strong and severe thunderstorms. Table 4 contains details about the color coding.

TRAC Report colors and intensities

Color	Rate/min	Classification
Green	1-10	Weak
Yellow	11-49	Moderate
Red	50-124	Strong
Orange	>125	Severe

Table 4

Flip tag button

The Flip tag button is used if you want to change the position of where the ident tag is displayed, by pressing this button the position of the tag will toggle between upper left and lower right corner of a TRAC target. Tags can also be positioned at the upper right or lower left if the target is close to the edge of the map display where it would otherwise disappear from view or be clipped. In those cases, pressing the Flip tag button will toggle between the currently used positions. Note that this button is available both in the TRAC Report dialog and through the On-map ident settings under the TRAC settings tab.

For additional configurable TRAC settings, refer to the Configuration dialog section, TRAC settings.

Note!

If you are using the Boltek LD-250 detector, classification of stroke type and polarity is not available and cannot be shown in the TRAC report. Because of this, the On-map ident tag will show a star (*) in place of the polarity sign.

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SEGMENTED RANGING CORRECTION KERNEL

In contrast to the non-linear General ranging correction that adjusts ranging of strikes for all directions, the Segmented ranging correction allows you to calibrate ranging on a per sector and distance segment basis.

The segmented ranging is linear, one unit of correction is equally worth no matter if the total calibration value is high or low.

Kernels
The Segmented ranging consists of 56 adjustable cells (8 sectors with 7 distance segments for each sector). When put together, these cells are called a ranging kernel. A kernel can be saved to disk and loaded at a later time. Once you change a kernel and save it, that particular kernel will be used by NexStorm for ranging until a different kernel is loaded or the kernel parameters are reset. You can have several kernels saved on disk but only one at a time can be used for ranging. Custom-made kernels should be stored in the \rkernel subfolder in NexStorm installation directory.

You can name each saved kernel differently, assign a revision number to it and write a short comment to keep track of changes you have made. To set a revision number or write comment for the currently loaded kernel, open the Kernel info dialog from within the Segmented ranging correction dialog.

Linking
When calibrating, you can link a sector or a distance segment so that the changes you make are synchronized for the whole sector or the distance segment in all sectors. You can also crosslink a sector with a distance segment or vice versa. Any change of value you then make will apply to all distance segments for that sector. Similarly, changes made to a distance segment will apply for all sectors if the distance segment is crosslinked with a sector.

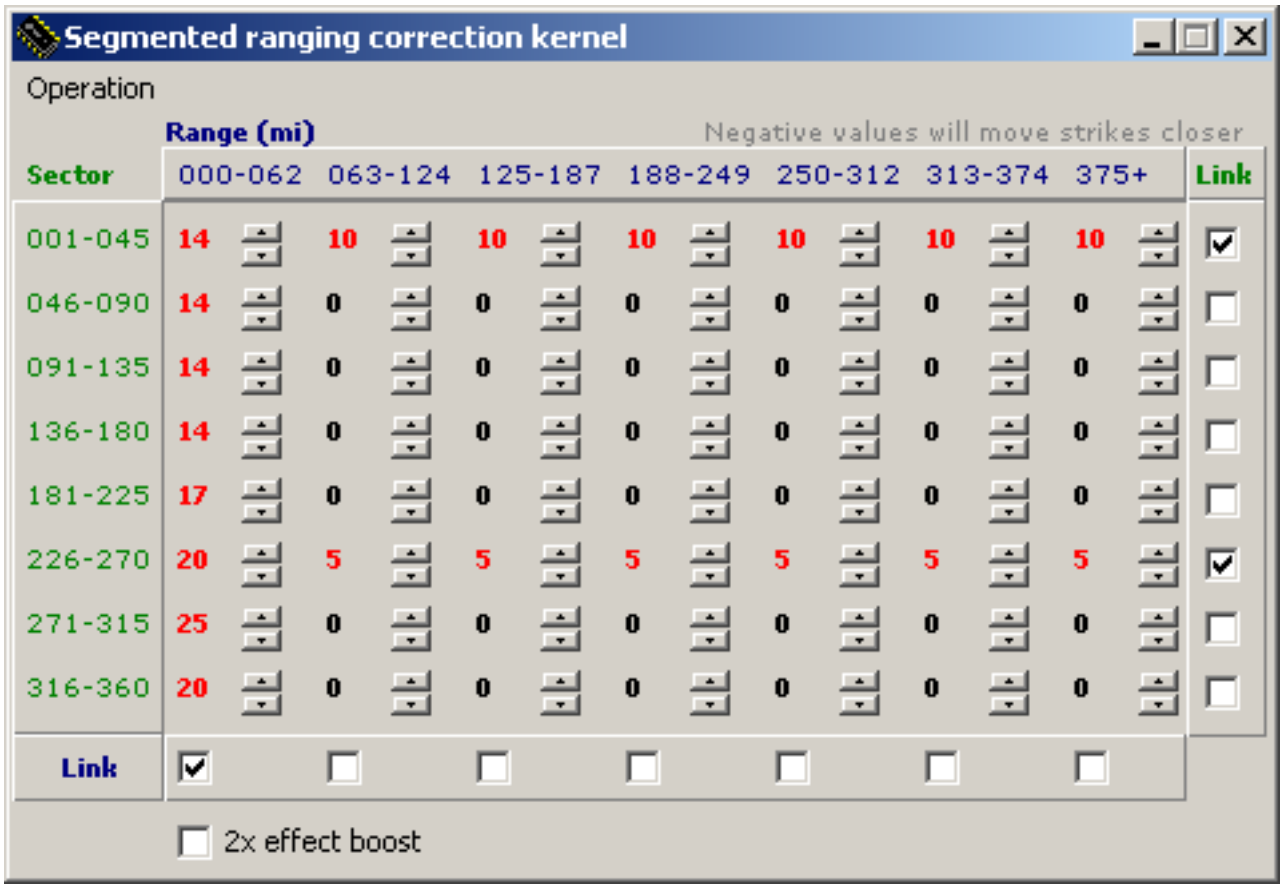

Figure 22. Linked ranges and sectors in the Segmented ranging correction kernel

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To fully understand the implementation of this feature it is recommended that you experiment with it by enabling and disabling linking while changing the values. After you are done experimenting you can reset the kernel to reset all ranging correction values to zero.

Note!
Ranging kernel sectors are automatically de-rotated which means that you do not have to account for any antenna alignment you have made while calibrating ranging. This means that you should modify ranging kernel sectors where storms are actually being shown on the map, without having to account for any antenna alignment that was made previously.

Calibration values
One unit of correction is equivalent to approximately one kilometer for the raw component of the strike signal. However, because TRAC modifies the location of each strike before it is plotted, the unit-to-distance relationship will always be altered to some degree, either upwards or downwards.

Negative values (blue color) will bring strikes closer towards center, positive values (red color) will push strikes out towards edge of the map.

Enabling **2x effect boost** will double the power of each unit of measurement. The actual ranging kernel value will not change, only its power.

How to calibrate
The recommended procedure when calibrating ranging is to first adjust the General ranging correction so that NexStorm ranges strikes as accurately as possible; then use the Segmented ranging for additional corrections required for the ranging to become optimal. Remember to have a great deal of patience when calibrating, this is not something you can expect to complete in a couple of days. It is of little use to calibrate on single, sporadic strikes or very weak storms. NexStorm accuracy normally increases with increased lightning activity so your best bet is to calibrate on storms that individually have strike rates of 5 strikes per minute or above.

To verify the new calibration settings you must allow the program to process several strikes before any changes will become evident. Calibrating ranging on real-time storms can therefore be time-consuming so the preferred way of doing this is by using the Replay feature.

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APPENDIX A – UPGRADING TO NEXSTORM

With this Free NexStorm Lite edition which ships with all Boltek StormTracker and LD-250 lightning detectors you get the same reliable and accurate thunderstorm distance ranging and tracking functions that are also available in the standard edition of NexStorm.

The Lite edition lacks however the advanced Internet publishing and real-time data sharing features, as well as some additional lightning analysis features which are only available in the standard edition. It also does not include any of the extras that are bundled with the standard edition of NexStorm.

Upgrade to NexStorm standard edition to get the following additional software and features:

- StormVue Java applet for viewing near real-time NexStorm lightning data on your web page
- SPARK Compact Lightning Explorer for viewing NexStorm data on your Java MIDP 2.0/CLDC1.1 mobile phone
- Automatic, in-memory screenshot capture
- Automatic TRAC report text file generation and storage to disk
- Automatic exporting of the StormVue datafile
- Automatic exporting of the SPARK.CLX datafile
- Full FTP capabilities for uploading the exported data and screenshots to your web server
- Full File Copy capabilities for replicating the exported data and screenshots within a LAN
- Additional 24,12,8 and 4 hours differentiated strike rate graph
- Full FlashGate functionality which will enable you to join one of our StrikeStar networks, and will also allow third-party applications to integrate live NexStorm lightning data into their own custom displays.
- Advanced Lightning Density Plot mode
- TRAC Info pop-up, point-and-click on a thunderstorm on the map to view characteristics and intensity
- Automated map zooming based on current storm locations
- Built in Composite Vector Map to Windows BMP converter
- Archive lightning data extraction command line utility
- Full NexStorm Lite edition compatibility for all common features

For more information or to upgrade, visit our website or go directly to the NexStorm web page here for full NexStorm standard edition specifications.

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APPENDIX B – SUPPORT

Hardware support

For hardware related issues or problems with the Boltek StormTracker PCI device driver for Windows, please contact Boltek at info@boltek.com

Software support

Before contacting support please visit our website and support forum to see if the problem that you are experiencing has already been reported, or if there are any software upgrades, solutions or workarounds available that may solve your problem.

You should also always try to replicate the problem with NexStorm running standalone on the computer where the problem was initially observed. This is to rule out any incompatibilities caused by other applications that may be running on the same computer as NexStorm.

If all else fails and you are unable to solve your problem please contact us or post your support issue on our message board. The software support email address is support@astrogenic.com.

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